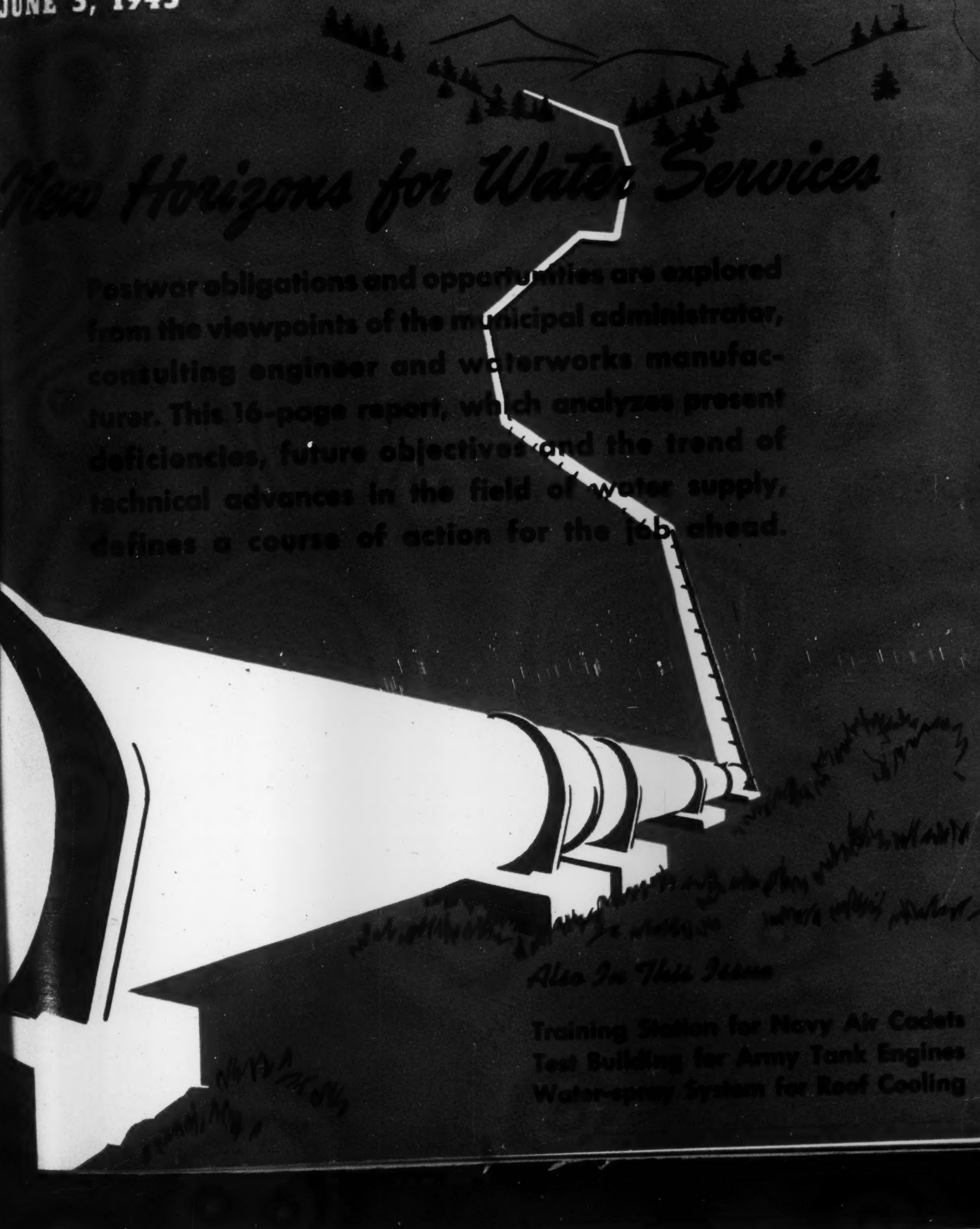
ENGINEERING NEWS-RECORD

JUNE 3, 1943



New Horizons for Water Services

Postwar obligations and opportunities are explored from the viewpoints of the municipal administrator, consulting engineer and waterworks manufacturer. This 16-page report, which analyzes present deficiencies, future objectives and the trend of technical advances in the field of water supply, defines a course of action for the job ahead.

Also In This Issue

Training Station for Navy Air Cadets
Test Building for Army Tank Engines
Water-spray System for Roof Cooling

It's Hard to Get Steel

BUT YOU CAN GET DRAINAGE

• America at war can afford no interruption of vital traffic. Proper drainage is doubly important now. Yet desirable as it is, steel must not be used in any drainage structure unless engineering integrity demands it. Even so, perhaps we can help you in other ways.

For example, ARMCO Emergency Pipe may be just the answer to your wartime drainage problems. This completely new design in wood pipe requires no steel sheets, bands, wire mesh or metal reinforcing. It is easy to handle and has ample strength to meet engineering standards. ARMCO Wood pipe is designed to last through the emergency. On more permanent installations, when replacement becomes necessary, a corrugated metal pipe may easily be threaded through or jacked around the wood structure.

Remember that ARMCO Corrugated Metal Pipe is only on temporary "leave of absence." It will be back with its flexible strength, ease of handling, tight joints, long lengths and low installation Asbestos-Bonded Coatings thick bituminous pavements back too—better than ever — to guard against corrosion erosion.

Meanwhile, can we assist your drainage problems? The swer may be in the use of non- tegic materials, or in suggestions repairing and salvaging older tures. Write to us for informat Armco Drainage Products Asso tion, 15 Curtis St., Middletown

ARMCO EMERGENCY PIPE

NGINEERING NEWS-RECORD

ted to Buildings, Sewers, Waterworks, Bridges, Roads, Dams, Foundations, Earthwork, Flood Control, Public Works, Shipbuilding, Irrigation, Canals, Railroads
McGRAW-HILL PUBLISHING COMPANY, INC.
lication Office: 99-129 North Broadway, Albany, N. Y. ● Editorial and Executive Offices: 330 West 42nd Street, New York
JOHN ABBINK, *Publisher*
WALDO G. BOWMAN, *Editor* **ALBERT E. PAXTON, *Manager***

. 130 JUNE 3, 1943 No. 22

OMING NEXT

o construct a multiple, barrel-
, concrete roof for an 82-acre
t within six months is a big
blem even under normal condi-
s. To have the problem further
plicated by a design that called
ribs 4 ft. 3 in. below the roof,
that 100,000 cu.yd. of concrete
to be poured during the Fall
Winter taxed the ingenuity of
contractor. How the problem
solved by the use of specially
igned retractable forms will be
cribed in *ENR* for June 17.

il for the air forces and mechan-
divisions of the Allied armies
soon be moving across the At-
ic in thin shell, heavily rein-
ed concrete hulls, planned to be
ed by ocean-going tugs. Con-
ction of these 366-ft. barges, de-
ed like conventional steel ships,
nique. Plant layout, pre-assem-
d forms, concrete pouring
hods and other features will be
cribed in June 17 issue.

simple but highly effective
hod of collecting and removing
face runoff from airports will
presented in *ENR*, June 17 issue.
s method features a new design
precast concrete box conduits,
r dished tops slotted to receive
runoff, are placed flush with top
pavement as an extension of the
ways and aprons.

LOOKING AHEAD

One of the finer "arts" in hy-
ulic engineering is the deter-
ation of the size, number and lo-
ion of the air-inlet valves on
elines in order to provide insur-
e against collapse that might re-
from the formation of a vac-
n. A practical step-by-step pro-
ure in making such determina-
s is outlined by Allen W.
eeten, research engineer of the
plex Valve & Meter Co., in an
icle that takes away all the
stery in—Air-Inlet Valve Design
Pipelines.

Design standards and construction
cedure for unreinforced concrete
h culverts—as developed by Kan-
highway engineers after exten-
research since 1941—will be the
ject of a thought provoking arti-
scheduled for an early issue.

PAGE

The Week's Events 85
Comment and Discussion 93
Editorials 94
Training Station for Navy Air Cadets 96
Bringing a Bridge Up to Date 102
Steel-Shell Piles for Unusual Foundation HARRY T. IMMERMAN .. 105
Thin Concrete Roof Withstands Fire Test J. E. KALINKA 108
Fighting Water in a Bridge Foundation 110
Glued Laminated Beams Carry Test Load 114
Setting Utilities Poles with High Explosives 115
Engine Test Cells Designed For Sound Reduction 116
Submergence Effect on Sharp-Crested Weirs
J. K. VENNARD AND R. F. WESTON 118
Water-Spray Cooling System for Flat Roofs A. B. TAPPAN 120
Cement-Grout Effectively Ends Maintainance Problem
HARRY F. SMITH 122
TVA's Safety Measures on Dam Construction 123
Street Repair Expenditures Justified by Weighted Estimates ... 125
From Field and Office 127
Book Notes and Reviews 128
New Horizons for Water Service EDWARD J. CLEARY 131
News of the Week 154
New Aids to the Constructor 168
Manufacturers' Activities 178
New Trade Publications 184
Men and Jobs 192
Meetings 196
Construction Reports 209

Number of copies of this issue printed: 35,963

DO YOU WANT AN INDEX?

Due to the paper shortage, no index for the current volume (Jan.-June, 1943) will be issued except to subscribers who ask for it. If you want a copy of the index please send in the coupon below.

Editor—Engineering News-Record
McGRAW-HILL PUBLISHING COMPANY
330 West 42d Street, New York, N. Y.

Please send Index to address below

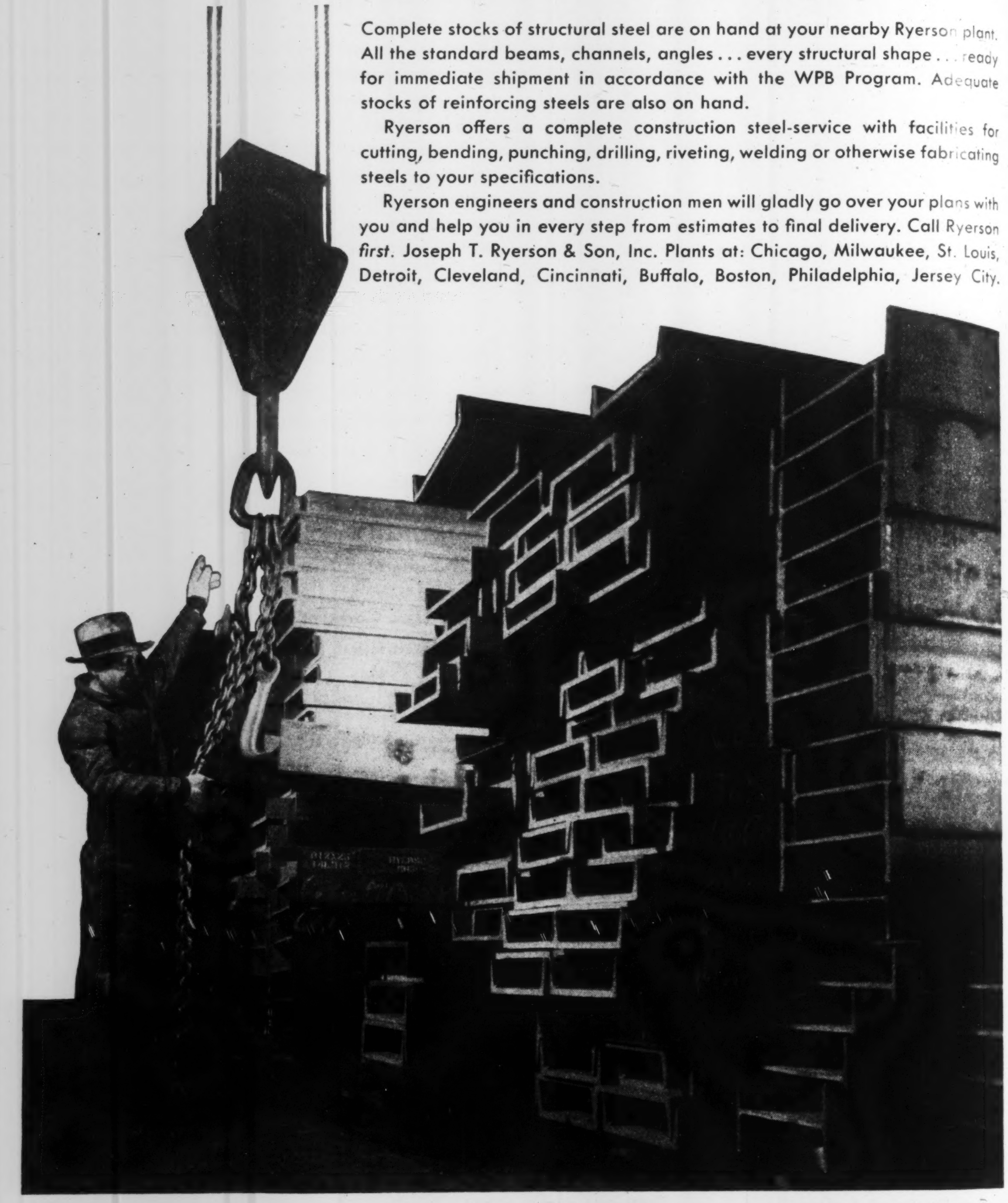
Name ....
Street ....
City ....

Structural Steels . . .
in Stock at Ryerson

Complete stocks of structural steel are on hand at your nearby Ryerson plant. All the standard beams, channels, angles . . . every structural shape . . . ready for immediate shipment in accordance with the WPB Program. Adequate stocks of reinforcing steels are also on hand.

Ryerson offers a complete construction steel-service with facilities for cutting, bending, punching, drilling, riveting, welding or otherwise fabricating steels to your specifications.

Ryerson engineers and construction men will gladly go over your plans with you and help you in every step from estimates to final delivery. Call Ryerson *first*. Joseph T. Ryerson & Son, Inc. Plants at: Chicago, Milwaukee, St. Louis, Detroit, Cleveland, Cincinnati, Buffalo, Boston, Philadelphia, Jersey City.



RYERSON STEEL–SERVICE

ONTHLY CONSTRUCTION BUSINESS SUMMARY

ENR CONSTRUCTION VOLUME AND NEW PRODUCTIVE CAPITAL

(,000 omitted)	May 1942 (4 wk.)	May 1943 (4 wk.)	% Change	Five Months 1942 (22 wk.)	Five Months 1943 (21 wk.)	% Change†
tinental U. S. Construction	$1,044,572	$273,650	−74.0	$3,936,356	$1,491,759	−60.0
ate Construction	49,325	22,014	−55.0	300,761	149,766	−48.0
ic Construction	995,247	251,636	−75.0	3,635,595	1,341,993	−61.0
ral	939,400	228,987	−76.0	3,348,013	1,263,588	−60.0
l New Productive Capital	$4,360,002	$13,143	−99.7	$6,818,823	$492,422	−92.0
ate Investment	29,952	12,643	−58.0	232,455	79,939	−64.0
ral (non-federal work)	16,050	500	−96.9	47,413	12,133	−73.0
ral (federal work)	4,314,000	....	....	6,538,955	400,350	−94.0
R Construction Volume Index (1913 = 100)	821	203	−75.3	575*	212*	−63.1

† Adjusted for difference in number of weeks reported. ** Five-month average.*

CONSTRUCTION COSTS ..... WAGE RATES ..... MATERIAL PRICES

	June 1942	June 1943	% Change	Changes May to June 1942 May	1942 June	%	1943 May	1943 June	%
R Construction Cost dex, 1913 = 100‡	274.19	289.94	+5.7	272.30	274.19	+0.7	289.87	289.94	**
R Building Cost Index, 13 = 100‡	221.18	227.71	+3.0	220.14	221.18	+0.5	227.64	227.71	**

‡ Does not reflect increased costs due to more overtime, lower labor efficiency, delivery delays, etc.

ENR 20-CITIES' AVERAGE

	June 1942	June 1943	% Change	1942 May	1942 June	%	1943 May	1943 June	%
mon Labor	$0.796	$0.863	+8.4	$0.788	$0.796	+1.0	$0.863	$0.863	0
ed Labor (Av. 3 trades)	1.553	1.614	+3.9	1.542	1.553	+0.7	1.614	1.614	0
klayers	1.654	1.703	+3.0	1.645	1.654	+0.5	1.703	1.703	0
ctural Ironworkers	1.612	1.671	+3.7	1.602	1.612	+0.6	1.671	1.671	0
penters	1.392	1.468	+5.5	1.379	1.392	+0.9	1.468	1.468	0
ent, per barrel	$2.60	$2.61	+0.4	$2.60	$2.60	0	$2.61	$2.61	0
forcing steel, cwt	2.69	2.73	+1.5	2.67	2.69	+0.7	2.74	2.73	−0.4
c. steel shapes, base	2.10	2.10	0	2.10	2.10	0	2.10	2.10	0
l, per ton	1.19	1.21	+1.7	1.19	1.19	0	1.21	1.21	0
ner, 2x4 Fir, per M ft.	48.43	51.13	+5.6	48.30	48.43	+0.3	50.88	51.13	+0.5
ber, 2x4 Pine, per M ft.	43.23	44.85	+3.8	42.82	43.23	+1.0	44.97	44.85	−0.3
k, common, per M	15.46	15.68	+1.4	15.41	15.46	+0.3	15.68	15.68	0
dy-mixed concrete, c.y.	7.33	7.37	+0.5	7.33	7.33	0	7.37	7.37	0
ct. clay tile, 3x12x12	76.96	78.97	+2.6	76.72	76.96	+0.3	78.97	78.97	0
ng asphalt, cars, ton	15.00	15.32	+2.1	14.93	15.00	+0.5	15.32	15.32	0

*** Less than .05 percent increase.*

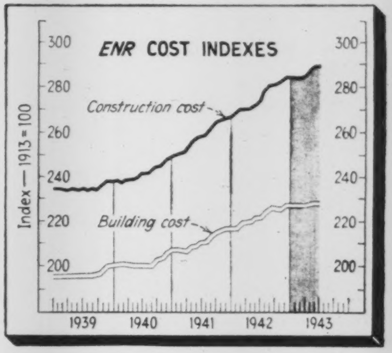
MATERIAL SHIPMENTS ..... BUILDING PERMITS

	May 1942	May 1943	% Change	April 1943	% Change Apr.-May
(% operating capacity) A.I.S.I.	99.3	98.9	−0.4	99.4	−0.5

	April 1942	April 1943	% Change	Four Months 1942	Four Months 1943	% Change
icated Structural Steel, tons, A.I.S.C.	187,205	97,982	−47.8	710,816	430,303	−39.4
ent, thous. bbl., U. S. B. of M	14,774	12,748	−13.7	44,745	40,152	−10.1
ding Permits, Dun & Bradstreet, 5 cities (,000 omitted)	$117,479	$49,790	−57.6	$371,114	$142,032	−61.7

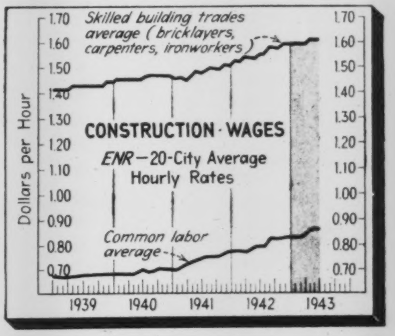
COST OF LIVING INDEXES ..... EMPLOYMENT

	April 1942	April 1943	% Change	Mar. 1943	% Change Mar.-Apr.
of Living Index, N.I.C.B	97.1	103.7	+6.8	102.8	+0.9
(Housing) Index, N.I.C.B.	91.0	90.8	−0.2	90.8	0
l Employment (est.), thous., B.L.S.	35,908	38,341	+6.9	38,184	+0.4
truction Employment (est.), thous., B.L.S.	1,771	1,295	−26.8	1,357	−4.6



ENR INDEX NUMBERS

Base = 100	Construction Cost 1913	Construction Cost 1926	Building Cost 1913	Building Cost 1926	Volume '13	Volume '26
June, 1943	289.94	139.37	227.71	123.09	...	...
May, 1943	289.87	139.34	227.64	123.06	203	89
April, 1943	288.80	138.83	227.50	122.98	225	99
Mar., 1943	285.24	137.11	226.66	122.53	228	100
Feb., 1943	283.48	136.27	226.90	122.66	231	101
Jan., 1943	283.45	136.25	226.87	122.64	172	76
Dec., 1942	283.69	136.37	226.63	122.51	227	100
Nov., 1942	283.64	136.35	226.58	122.48	462	202
Oct., 1942	282.44	135.77	225.90	122.11	421	185
Sept., 1942	281.61	135.37	225.46	121.88	544	238
Aug., 1942	281.61	135.37	225.39	121.84	622	273
July, 1942	277.65	133.46	223.45	120.79	736	323
June, 1942	274.19	131.80	221.18	119.56	752	330
May, 1942	272.30	130.89	220.14	119.00	821	360
1942 (Av.)	276.31	132.82	222.39	120.22	553	243
1941 (Av.)	257.84	123.95	211.46	114.32	375	164
1940 (Av.)	241.96	116.31	202.81	109.64	269	118
1939 (Av.)	235.51	113.21	197.44	106.73	211	92



ENGINEERING CONSTRUCTION CONTRACTS——ENGINEERING NEWS-RECORD——MAY, 1943

ineering News-Record *reports continental U. S. construction projects of the following minimum costs—waterworks, excavation, drainage and irrigation,* $15,000; *other public works,* $25,000; *industrial buildings,* $40,000; *other buildings,* $150,000

Four Weeks—Thousands of Dollars (000 Omitted)

	New England	Middle Atlantic	South	Mid West	West of Mississippi	Far West	United States May 1943	United States Five Months 1943	United States Five Months 1942	Canada
lic Works										
Waterworks	118	308	3,140	162	788	100	4,616	23,084	45,462	347
Sewerage	234	369	1,033	294	682	918	3,530	16,895	44,424	273
Bridges, public	57	....	423	418	128	91	1,117	8,470	27,272	....
Earthworth and waterways	....	15	922	534	3,419	134	5,024	16,469	168,086	87
Streets and roads	1,118	2,460	7,914	11,352	6,543	2,812	32,199	96,836	180,925	1,953
Buildings, public	5,368	15,277	23,549	10,529	19,125	23,484	97,332	730,608	2,505,277	3,302
Unclassified, public	3,314	6,581	34,333	24,699	27,530	11,361	107,818	449,631	664,149	1,170
l public	**10,209**	**25,010**	**71,314**	**47,988**	**58,215**	**38,900**	**251,636**	**1,341,993**	**3,635,595**	**7,132**
Federal government (included in above classifications)	9,665	23,180	65,867	36,296	55,843	38,136	228,987	1,263,588	3,348,013	....
ate										
Bridges, private	....	....	600	....	....	....	600	2,150	205	....
Industrial buildings	507	598	545	847	335	1,375	4,207	48,881	120,577	3,608
Commercial buildings	4,068	1,690	....	2,238	310	6,154	14,460	84,295	152,870	2,357
Unclassified, private	....	345	407	890	800	305	2,747	14,440	27,109	....
l private	4,575	2,633	1,552	3,975	1,445	7,834	22,014	149,766	300,761	5,965
l Engineering Construction										
, 1943 — 4 weeks	**14,784**	**27,643**	**72,866**	**51,963**	**59,660**	**46,734**	**273,650**	....	....	**13,097**
l 1943 — 5 weeks	16,835	64,253	94,645	54,736	69,746	78,853	379,068	....	....	8,533
, 1942 — 4 weeks	30,187	166,494	226,507	227,216	240,237	153,931	1,044,572	....	....	16,689
Months — 1943	**68,299**	**193,531**	**350,826**	**191,919**	**336,706**	**350,478**	....	**1,491,759**	....	**44,714**
Months — 1942	156,990	608,807	891,531	745,336	846,670	687,022	....	....	3,936,356	68,955

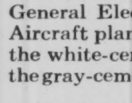
Why does this man get 61% MORE LIGHT?

Light from floors is the answer. Light-colored floors made with Atlas *White* portland cement instead of standard *gray* portland cement or still darker materials increase illumination on vertical work surfaces and undersurfaces. With better illumination, workers see better, spoilage decreases and production increases.

When light strikes a dark floor, most of it is absorbed. It is wasted. When light strikes a light-colored concrete floor made with white cement, much of it is reflected. The light is salvaged. It is used over and over again. Tests by General Electric in the Consolidated Aircraft plant at Fort Worth show that the white-cement floor compared with the gray-cement floor in the same plant—

- ▶ *reduces shadows and dark areas;*
- ▶ *increases illumination on vertical work surfaces by 20%;*
- ▶ *increases illumination on underside work surfaces by 61%.*

Light-colored concrete floors made with Atlas *White* portland cement help bring the production-speeding advantages of better light. For the complete story, write today for your copy of the new 24-page book, "Light from Floors." Universal Atlas Cement Company (United States Steel Corporation subsidiary), Chrysler Building, New York City.



HOW ABOUT MAINTENANCE?

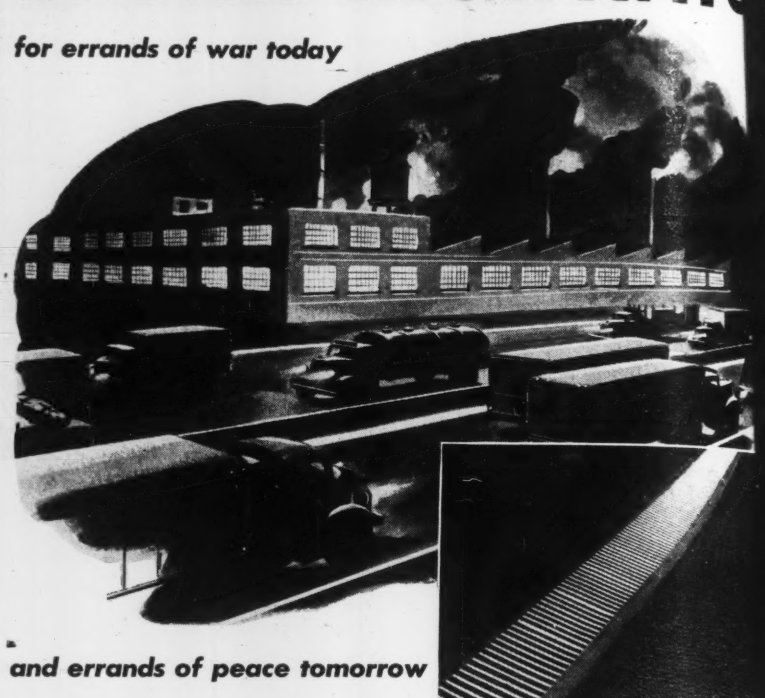
Experience shows white-cement floors are easy to clean, easy to keep clean, and retain their reflection advantage. Maintenance is simple—frequent sweeping, occasional damp mopping, periodic scrubbing.

ENR-F-18

ATLAS
WHITE CEMENT
For Light-Reflecting Floors

SAFER HIGHWAYS

for errands of war today



and errands of peace tomorrow

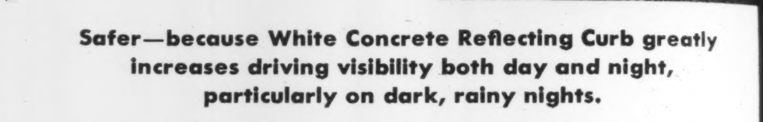
Safer—because White Concrete Reflecting Curb greatly increases driving visibility both day and night, particularly on dark, rainy nights.

White Concrete Reflecting Curb is one important assurance of safety for the fleets of trucks which are speeding vital war cargo along our highways. Miles of this new safety curb, made with Atlas White cement, are in use today on pre-war highways and military roads. And everywhere it is being used, it is successfully promoting driving safety. The diagram below shows you how and why.

You will want to keep White Concrete Reflecting Curb in mind for the war and post-war roadways you plan to build. The complete story is contained in a new book, "A White Guide to Safety." Write to Universal Atlas Cement Company (United States Steel Corporation Subsidiary), Chrysler Building, New York City.

OFFICES: *New York, Chicago, Philadelphia, Boston, Albany, Pittsburgh, Cleveland, Minneapolis, Duluth, St. Louis, Kansas City, Des Moines, Birmingham, Waco.*

ENR-M-35



When headlights strike smooth curb, the light is wasted—it is reflected forward, away from the driver—visibility is low or nil. But when headlights strike Reflecting Curb, its saw-toothed faces reflect the light directly back to the driver's eyes. Result: a gleaming white guide to safety.

ATLAS WHITE CEMENT
for white concrete reflecting curb

he Week In Engineering and Construction

NGINEERING NEWS-RECORD • JUNE 3, 1943 • VOLUME 130 • NUMBER 22

iews vary widely on size of postwar works program

One school of thought in Washington still favors a large public-works program while another group considers a large program impossible of early attainment.

There is practical unanimity within Roosevelt administration—and gen- l agreement everywhere — on the cessity for some sort of works pro- am after the war. But significant di- rgences have developed in Washington to the scale of the postwar program. scussion has been stimulated by the esident's recommendation to Congress t $85,000,000 be appropriated to as- t state and local agencies in prepara- n of plans and specifications (*ENR*, ay 27, p. 769).

Big program favored

In the past, the standard New Deal swer to economic dilemmas was pub- c works—the more the better. The limit the amount undertaken was how much ongress could be induced to appropri- e. Now, however, some thinking among e New Dealers themselves is along the ne that there are distinct limits to hat can be accomplished with public orks.

Leader of the faction advocating a g public works program has been and Alvin Hanson of the Federal Reserve oard. It was this group that inspired e Thomas Urban Rehabilitation Bill (*ENR*, Apr. 29, p. 644 & Apr. 8, p. 465) w in the Senate. This group believes at if a tolerable level of employment is be maintained after the war, there st be a construction program of ten to elve billion dollars a year in the first o years after the peace—of which at st four or five billion would have to be blic works—rising to fifteen to eight- n billion in later years.

Construction industry task

This group argues that even though e manufacturing industries convert pidly to peace production, they will ll employ fewer men than they do w; that construction will have to ac- unt for from two million to two and half million men. They also point out that immediately after the last war, construction amounted to about six billions, which is equivalent to the ten billion figure in relation to the higher level of national income.

Limits on the program

Quite divergent views are held by another group, particularly within the National Resources Planning Board. These men hold that it will be quite impossible to achieve any such level of construction soon after the war. It is pointed out that by the end of the war, construction will probably have dropped to an annual level of about a billion and a half, and the argument is made that there are definite limits to the rapidity with which this can be increased—limits set by time required to make designs, finance the work, let contracts, and get work going.

Basing their estimates on the rate at which construction volume increased during the early days of the present war, these economists believe that the best which could be expected would be a construction volume of less than 4½ billions the first year, and 8 billions the second. A 10-billion rate would not be reached until the third year, and a 13½-billion rate the fourth. This would call for public works expenditures of something like 1.3 billions the first year, 2.2 the second, 3.1 the third, and 4 billion the fourth.

The President's program of last week doesn't commit him to either view. His proposal would finance plans and specifications for about a billion and a half dollars worth of non-federal projects, plus an undetermined volume of federal public works projects.

•

Road funds released for flood repair

President Roosevelt has released impounded federal-aid highway funds for use in reconstructing flood-damaged roads in the Middle West. For many months, use of federal-aid money has been restricted to highway projects certified as essential to the war effort. This has resulted in a large accumulation of such funds to the credit of state highway departments.

The effect of the President's move is to raise the restriction on use of these funds if they are used to repair flood damage. Thus all unobligated federal-aid funds in the affected states becomes available for use on a regular federal-aid basis with fifty-fifty matching by the states from their own funds.

No complete estimates of the amount of highway damage done by the floods are yet available, but preliminary and partial estimates already run to $15,000,000. Sure to take advantage of the newly available funds are Indiana, Illinois, Missouri, Kansas, Oklahoma, and Arkansas. Texas and Louisiana will probably do so and possibly Kentucky, Tennessee, Mississippi, and Nebraska.

Serious damage in Arkansas

Among the most seriously damaged highways is U. S. Route 64 on the Fort Smith side of the Van Buren Bridge over the flooded Arkansas River. About 1,800 ft. of this bridge approach has been washed out, taking with it a water main serving the city (*ENR* May 20, p. 720, and May 27, p. 770). The highway department planned to build 800 ft. of temporary trestle following the first crest in the river flood, but the second flood lengthened the area to be bridged to 1,000 ft. Four pile drivers are on hand ready to start work as soon as the river subsides sufficiently. W. W. Mitchell, director of the state highway department, believes that 3,000 ft. of this highway will have to be raised to make it safe from future floods.

Estimate of the total damage to Arkansas highways cannot be made until the floods subside. Many miles are known to be badly damaged by shoulder washes and undermining.

Alcan highway may be brought into Edmonton from Dawson Creek

Surveys and cost estimates for the road have been made by Canadian and United States engineers

While the United States has intimated on several occasions that it regards Dawson Creek, B C., as the southern terminus of its road construction program, Hon. W. A. Fallow, minister of public works, railways and telephones in Alberta has refused to accept this statement as final. Negotiations are in progress for bringing the Alaska highway into Edmonton from its Dawson Creek terminus, and so successful has Mr. Fallow been in the promotion of this project that surveys and cost estimates for the road have already been made by engineers of both the Alberta and United States governments. Mr. Fallow says that need for the continuation of the Alaska highway right into Edmonton is admitted by both parties, but cost of financing is still to be settled.

Ottawa disclaims monetary responsibility and Alberta takes the position that the road, which would run chiefly through undeveloped territory, must be regarded as a war measure. In any case, Alberta lacks the funds, the Minister says.

The purpose of the extension would be to supplement existing road and railway services for supplies destined for the northern military bases. As minister of railways, Mr. Fallow had no hesitation in stating that the Northern Alberta Railway is inadequate. Freight that the railway could not handle was carried all last winter by truck convoy from Edmonton. It followed a devious route over dirt roads hard-surfaced by frost but which were never intended for ten-ton trucks at other seasons of the year.

The road now projected would cut 85 miles from the present 465-mile journey. It would involve the use and improvement of sections of roads already graded for large distances at both the northern and southern ends. From Whitecourt to Valleyview, however, the builders would have to carve a path through virgin country. This is a jump of 125 miles. Three main bridges would be required, Mr. Fallow said. The largest would be a 1000-foot span across the Athabaska River 30 miles west of Whitecourt. The other two would cross the Smoky and Little Smoky rivers.

A second Alaskan highway?

The minister also visualizes a second Alaskan Highway to be built north and east of the present road. Work on it is being done by U. S. authorities now, he stated, to take supplies into the Norman oil fields. Mr. Fallow said freight was taken in over the new route last winter. It runs almost due north from Peace River up the Hay River and will pass through easier country than the first road. In his view, both major roads will be needed to carry the flow of trade to and from the untapped regions of the sub-Arctic, since Edmonton stands at the mouth of the bottle-neck through which the natural resources of the north must pass.

Although there are three bridges across the Saskatchewan River now, the traffic is so heavy that a fourth is being considered. Parties of U. S. Army engineers are seen daily on the banks of the river at two sites where a bridge might be constructed.

• • •

A. W. Brandt retires; N. Y. public-works head

Arthur W. Brandt, head of the New York State Department of Public Works since March, 1939, retired on May 20, after 30 years of nearly continuous service in the department. As superintendent he was in charge of the divisions of canals, highways, engineering, architecture and public buildings.

Born in Wayne County, N. Y., in 1888, Mr. Brandt graduated from Tuft's College as a civil engineer in 1912 and served in the state divisions of canals and highways until 1917 when he entered the army, ultimately becoming a captain in the First Engineers, First Division. Upon completion of his military service he was appointed secretary and second commissioner of the New York State division of highways, becoming commissioner in 1924, and superintendent of public works in 1939. As noted in last week's issue, Charles H. Sells succeeded Mr. Brandt as head of the department upon his retirement.

• • •

Equipment speeded to the Army Engineers

Special equipment is being delivered to the Corps of Engineers of the Army Service Forces at a greatly accelerated rate, the War Department has revealed.

Delivery of special equipment to the corps reached a total of $62,468,000 last month, a 279 percent increase over April, 1942. May deliveries are expected to be increased by almost $10,000,000 more, when the reports for that month all in.

The importance of amphibious fare and the necessity for river cros in battle plans are reflected in the s increase in deliveries of boats, bri and bridging equipment, which the port shows to be more than 29 times April, 1942, deliveries.

Delivery of steel mats for airfield struction increased by 353 percent April, 1942, searchlights by 525 perc and delivery of other lighting equipm jumped almost 15-fold.

Mobile engineer shops, equipped tools to perform almost any mach shop job, jumped in April deliveries more than 14 times the April, 1942, ure. Another big increase was noted the acceptance of construction equ ment, which showed a rise of 179 p cent over last year.

• • •

Flood crests fall in Arkansas valley

Flood crests all along the lower kansas River valley were falling on M 31 as the main body of the flood mov out into the Mississippi. At Pine Blu Ark., where levees of local levee d tricts join those built along the Arkans River as part of the flood-control sy tem of the lower Mississippi, the riv stood at 33.8 ft. on May 28, setting a all-time high, 0.8 ft. above the 1935 cres Little trouble is expected below Pi Bluff because of the more substanti levees of the Mississippi system. Pi Bluff escaped with minor flooding.

Upstream, between Pine Bluff an Fort Smith, Army engineers were mak ing active plans to help local levee dis tricts to repair breaks as a third ris in the river threatened, there being som additional rainfall in the upper part o the valley.

Mississippi flood crests

At St. Louis, the Mississippi River reached a flood crest of 38.9, or 8.9 ft above flood stage. At Cape Girardeau, Mo., the Mississippi River, swelled by floodwaters from the Illinois and Big Muddy rivers, in addition to those from the Missouri River stood at 42.4 ft. the highest mark in history. Flood stage there is 32 ft. Downstream, at Cairo, Ill., the Mississippi was reported as circling that city to form a new junction with the Ohio, which is not in flood. The waters were running up an old creek valley to reach the Ohio seven miles above the present confluence of the two rivers.

On May 31 the crest reached Cairo, standing at 53 ft. or 13 ft. above flood stage. Below Cairo, the crest is flattening; it is expected to reach Memphis June 4 or 5 and to be only 3 ft. above the 34-ft. flood stage.

Housing Progress—plans and projects

Throughout the nation steady progress is being made to provide adequate using facilities for war workers. At the same time plans are being promoted r postwar housing to overcome long standing deficiencies.

In the City of Washington, in other rts of the District of Columbia and in ighboring parts of Maryland and Vir-nia, a wide variety of living quarters is nbraced in the program, ranging from odern hotels and apartments to bar-cks and small experimental houses of e abode type. Some of these projects ve been completed, others are nearing mpletion and still others are near the nstruction stage.

Under the direction of the NHA, this ogram involving use of both public d private financing, is designed to commodate at least 175,000 workers, ostly at low rentals. The housing has en designed not only to meet the need the government's increasing force of ar workers but also to help, if possible, relieving the strain on the city's ansportation system.

Through new construction or remodel-g, housing accomodations for 124,000 coming war workers are being pro-ded in the industrial centers of the utheast, the regional office of the Na-onal Housing Agency at Atlanta, Ga. nounced recently.

Of this total war housing program for e Southeast, more than 50,000 units f all types had been completed by pril 1, close to 30,000 units were un-er construction on that date, and the emainder are scheduled for completion y fall, Robert K. Creighton, regional epresentative, said. War housing ac-vity in the Southeast embraces local uilding programs in approximately 110 ties or communities in North Carolina, outh Carolina, Georgia, Florida, Ala-ama, Mississippi and Tennessee.

The 123,467 war housing accommoda-ons thus far scheduled for the South-ast include 32,571 privately financed amily dwellings, 63,886 publicly fi-anced family units, 19,400 publicly fi-anced dormitory units, 3,220 publicly nanced trailers, 980 family units hrough privately financed conversions f existing buildings, 3,200 family units hrough publicly financed conversions, nd 140 room spaces through privately nanced conversions of existing dwelling nits.

The first step has been taken in New-rk, N. J., in a campaign to interest the ederal government in building addi-onal war housing projects in that city. ublic Affairs Director Brady is heading e efforts which are being made in this irection. There is an acute shortage f war workers accommodations in New-rk and vicinity.

Cooperating with the Newark Public Affairs Director is the Newark Housing Authority, through its executive director Frank B. Wenrich. Officials of National Housing Agency, Federal Public Housing Authority and State Housing Authority have already gone on record as being in accord with the campaign and have given assurances of support.

Construction of better housing for millions of Americans who will demand higher standards of decency and comfort will play a major role in the nation's postwar economy, John B. Blandford, Jr., administrator of the National Housing Agency, told a joint meeting of the National Association of Housing Officials and the American Society of Planning Officials, both in annual session in New York on May 19.

"We will enter the postwar period with a tremendous deferred demand for new or rehabilitated housing," Mr. Blandford said. "This backlog will not merely reflect the necessary cutoff of a large proportion of normal residential building during war years but it will also reflect the fact that we have never overcome the housing deficiency carried over from the depression of the early '30s. When victory comes there will be a vast reservoir of personal and institutional savings available for investment in or purchase of durable goods not obtainable during the war period. Housing is clearly in the latter category. Ample materials, manpower and money will be available for a substantial peace-time housing program."

New York City has advanced plans for extensive new housing developments bordering the East River Drive on the lower East Side. Except for a gap of only a few blocks the proposed propects —Stuyvesant Town, Jacob Riis Houses and Lillian Wald Houses—will extend along the drive from East Houston Street to 20th Street.

Lillian Wald Houses, a state-financed project, will run from East Houston Street to Sixth Street. Jacob Riis Houses, a federally-financed project, will run from Sixth Street to Eleventh Street. Both will lie between East River Drive and Avenue D. At Fourteenth Street, Stuyvesant Town, proposed Metropolitan Life Insurance Co. project, will begin, occupying a site bounded by 14th Street on the south, 20th Street on the north, East River Drive and Avenue C on the east and First Avenue on the west.

• • •

Connecticut to finance Charter Oak bridge

The Connecticut Assembly has provided that deficits in operating costs of the Charter Oak toll bridge as well as bond payments shall be made up by the state from the general funds. Repayment will be made whenever toll receipts are in excess of expenses.

Reports from the bridge commission show automobile traffic over the Charter Oak bridge spanning the Connecticut River between Hartford and East Hartford, rose sharply during April. Total revenues from toll collections amounted to $16,657.45, an increase of 11 percent over March receipts. Passenger car traffic was up 14 percent and commercial traffic up 12 percent.

This bridge was opened Sept. 8, 1942, and has been used by 1,243,812 vehicles.

Planning board curtailed by Senate

On May 27 the Senate voted, 44 to 31, to reduce the National Resources Planning Board to a skeleton organization, with functions restricted to cooperation with state and local agencies in their war and postwar planning.

Only $200,000 was allowed of the $1,400,000 the agency sought to finance its operations through the coming fiscal year.

There was bipartisan opposition, headed by Senator Taft of Ohio and Senator Tydings of Maryland, who claimed that the board has been sponsoring plans based upon a philosophy "partly socialism and partly the product of a dangerous imagination."

With a vote of 43-31, the upper house rejected an amendment by Senator McKellar, which would have allowed $534,422 to the N.R.P.B. upon which to operate through the next year. For this year the Budget Bureau had approved $650,000 for salaries and expenses, $725,000 for national defense activities and $25,000 for reports, making the total of $1,400,000.

To make certain that the N.R.P.B. will get no money other than that specifically authorized by the Congress the Deficiency Appropriation Bill contains a special provision. This prohibits the President from transferring any of the money in his $85,000,000 special emergency fund (*ENR*, May 27, 1943, p. 769) to any project or function for which the Congress has refused to appropriate in accordance with budget estimates.

Contractors face trouble in gasoline shortage

The Office of Defense Transportation this week is buckling down to dealing with a gasoline shortage which already is shutting down construction jobs here and there in the Eastern states. There is nothing ODT can do about the shortage. Although intensified by transportation difficulties resulting from the Middle-Western floods, it is caused basically by the drain of fuel across the Atlantic.

Commercial use cut

What ODT can do—and is starting to do—is to try to ensure that the limited supplies of gasoline available for East Coast civilians reach the most important users. The first step, which already is in effect, was to cut the value of outstanding commercial T ration coupons by extending their expiration date. This cut affected all commercial users alike.

Supplementary allotments

Then, ODT announced that it would consider granting supplemental allotments of gasoline to essential users. Those wanting such allotments must apply to the nearest district office of the ODT and be prepared to justify the request. The justification involves two steps.

First, the applicant must be prepared to demonstrate from his operating records that he is making the most efficient possible use of his vehicles. This may present some difficulties to construction men. ODT lays great stress on capacity loading of vehicles, and construction trucks necessarily often run empty half the time. The requirement of maximum use is supposed to be based on the nature of the use being made of the trucks, but the proof will be more difficult for construction men.

Secondly, it must be shown that the applicant's business fits into the priority list laid out by ODT and WPB.

Priorities of little use

Here construction men are really in trouble. The fact that a job is aided by a priority rating will not be taken as necessarily proving its essential nature. And the trouble is that construction is not specifically listed as such in the list of essential activities. There is a general clause, authorizing extra gas for "services necessary to the war effort or essential civilian activity." This thus leaves it up to the contractor to prove that his activity is essential. This should offer no difficulties to contractors on war factories, airfields, and such but may cause difficulty on marginal jobs such as war housing.

Appeal from the decision of an ODT district office can be taken to the regional offices.

Irrigation to provide dust control at Yuma

Construction of irrigation facilities on the Gila project of the Bureau of Reclamation in Arizona will be expedited to provide dust control for the Yuma army air base and to help increase food supplies in the Pacific Southwest, Secretary of the Interior Harold L. Ickes has announced.

Acting Commissioner H. W. Bashore, of the Bureau of Reclamation, has advised Secretary Ickes that the Facility Review Committee of the War Production Board had removed a limitation which required 8,500 acres of the land to be irrigated primarily for guayule rubber planting. Work on the Gila project originally was cleared by the War Production Board to have the land ready for guayule if required by the Emergency Rubber Project. At the request of the Army authorities in the Southwest, consideration was given to assuring dust control in the vicinity of Yuma.

WASHINGTON HIGHLIGHTS

WPB's Facilities Bureau has been revised in the light of the new tighter policy on construction of facilities. Responsibility for the approval or disapproval of specific projects rests with two committees—the industrial facility committee and the non-industrial facility committee. Under Director Charles E. Volkhardt, the Facilities Bureau will function as a staff for these committees. A project division will establish the procedures and criteria for approval of projects; it will also take over the job of administering L-41, which has been handled in New York by the now-abolished construction division. A production resources division in the bureau will be responsible for seeing that maximum use is made of existing facilities—for instance: by concentrating the work of two partly idle munitions plants into one and releasing the other—thus reducing the need for new facilities. Finally, a progress and scheduling division will be responsible for timing the construction of facilities in relation to needs and scheduling the flow of construction materials into projects.

The National Resources Planning Board will be continued on a small scale if the House accedes to the action of the Senate in appropriating $200,000 for the agency. The House had eliminated entirely a budget request of nearly a million for NRPB, but the Senate inserted the $200,000 after defeating an atte to get about a half million.

All available flood control funds of Corps of Engineers, some $30,000, would be made available for flood r and repair work under the terms o bill introduced last week by Sen Lucas.

• • •

Public works expanded in Puerto Rico

Work on a 10-million-gallon stor tank at Trujillo Alto, Puerto Rico, started last month to supply water the city of San Juan. The contract, proved by the Federal Works Agency a the Insular Department of Health, p vides for the construction of a concr storage tank which will cost $188,0 and must be finished within nine mont The new storage tank will be used as reservoir for all surplus water after has been treated at the Guaynabo a Rio Piedras filter plants of the San Ju water supply system.

Much work planned

Roy Schroder, director of the WPA Puerto Rico, commenting on the approv by the U. S. Senate of legislation pr viding for an appropriation of $50,00 000 for a new public works program Puerto Rico, declared that road constru tion, street paving, sewerage system malaria control and public health pro ects are the principal aims of the ne federal set-up. Food planting will als be one of its purposes.

The new program will be wider tha that of the almost defunct WPA, espe cially in regard to employment. M Schroder said. It will consider a wor program rather than a relief project and the new program is designed to giv jobs to persons who have lost thei employment as a result of the war.

Postwar planning

Bills for a postwar public works pro gram which it is hoped will add new homes, schools, hospitals, roads, bridges and other public improvements in Puerto Rico, was signed by Gov. Rexford G. Tugwell on May 14. This new legislation will enable the Insular government to buy lands desirable for public works development, and to plan and design specific projects. The bills appropriate $300,000 to pay for the designs for the large program of public works. Also created is a committee on design of public works, consisting of the Commissioner of the Interior, the chairman of the planning board, the director of the budget, the director of the war emergency program and another person to be appointed by the governor.

onstruction Communiques

Engineering News from the Battlefronts

orth **Africa**—Before the successful clusion of the North African cam- n, U. S. Army Engineers were build- roads at a rate of 4 miles an hour. ecially organized pioneer road teams e the speedy construction possible. owerful six-wheel drive truck carry- a tractor with a bulldozer run ahead attack difficult crossing points such steep banked washouts. It was fol- ed by "V" drags, pulled either by tors or tanks at a rate of 12 miles hour. These cleared the roadway of ris and did some grading. A high ed motorized grader finished the job. leanwhile the amphibian engineers e learned, through the use of mesh ndations, to build beachheads for vy trucks in five to ten minutes. The ny Engineers have many other highly cialized units which accomplished er important tasks. They purified ter, supervised all camouflage instal- ions, handled demolition projects, de maps, laid and cleared mine fields, ated obstacles and constructed roads, dges and air bases.

abrador—Goose Airport, one of the st important in the world, was built by McNamara Construction Co., Toronto, t. It took 18 months to build and was npletely constructed without one shot of dynamite, and there was no problem of building power lines because the nearest such power was hundreds of miles away. Diesel-created power was used instead. The job facing the engineers was to get equipment from ship to shore, to get the equipment from shore into the bush and to get the bush cleared away and an airport built.

Tractors and bulldozers cleared an area where a sawmill could be set up and bush men went into the forest dropping trees. A pile driver was built and a dock was started.

While the sawmill ground out lumber for buildings, big bulldozers were hammering their way up the slope leading from the water's edge to the plateau. It took days to reach that plateau, but once on top the plan was simple—they just began pushing everything off the top of the plateau back down the slopes. A huge clearing of hundreds of acres was made and the hummocks from it were pushed back into a long ramp leading toward the docks.

From this clearing the bulldozers headed for the future runways. Working in pairs, they cleared 2,000-ft.-long strips. Today those strips are over a mile long. Within three weeks strips had been cleared and levelled and were ready for airport operations.

---

ower plant in operation t Green Mountain Dam

he Bureau of Reclamation has placed 30th power plant in war service, Sec- ary of the Interior Harold L. Ickes announced. The plant is located at een Mountain Dam in western Colo- o, and is a part of the Colorado-Big mpson project, the primary purpose which is to provide a supplemental gation water supply in northeastern orado. Power from the new plant l serve Denver and other areas where re are expanding war industries.

hen the plant's first generator began nmercial production, more than 10,000 of new war power became available, ing Commissioner Henry W. Bashore orted to the Secretary. A second t, of equal size, is scheduled to be operation soon, making the plant of icient capacity to supply a city of 00 inhabitants. Ultimately six other er plants will bring the potential an- l output of the Colorado-Big Thomp- project to about 900,000,000-kw.hr., ivalent to the 1941 output of all the erating capacity in the state of orado.

"Engineer-in-training" added to model law

Revisions of the model registration law for engineers which are intended to hasten nation-wide acceptance of the classification "engineer-in-training" were approved on May 24 by representatives of ten national engineering societies at a meeting held in New York on invitation from the committee on registration of engineers of the American Society of Civil Engineers. These revisions and other minor ones designed to clarify the law now go to the collaborating organizations for their approval.

The principal revision is one adding the following paragraph to Section 2 of the model law:

> The term engineer-in-training as used in this act shall mean a candidate for registration as a professional engineer who is a graduate from an approved engineering curriculum of four years or more in a school or college approved by the board as of satisfactory standing, or who has had four years or more of experience in engineering work of a character satisfactory to the board; and who, in addition, has successfully passed the examination in the fundamental engineering subjects prior to completion of the requisite years of experience in engineering work, as provided in Section 14 of this act, and who shall have received from the board, as hereinafter defined, a certificate stating that he has successfully passed this portion of the professional examinations.

Other provisions added to the law with respect to engineers-in-training include issuance of a certificate to engineers who pass the examination in engineering fundamentals, also one setting a fee for the examination.

New York State will hold its first examinations for certificates as engineers-in-training this month; Ohio has just amended its license law to permit its license board to hold such preliminary examinations and issue certificates. As a means for helping young engineers during the time required in other states to adopt similar provisions, the National Council of State Boards of Engineering Examiners is considering the possibility of examining young engineering graduates and issuing certificates as engineers-in-training to those who pass.

Participating in the New York meeting were the following: American Society of Civil Engineers, T. Keith Legare: chairman of the meeting, Robert H. Craig, H. G. Sours, N. W. Dougherty; American Association of Engineers, James H. Griffin, Arthur Richards; American Institute of Chemical Engineers, Stephen Tyler; American Institute of Consulting Engineers, Charles F. Scott; American Institute of Electrical Engineers, C. R. Beardsley; American Society of Mechanical Engineers and the Society for the Promotion of Engineering Education, R. L. Sackett; American Institute of Mining and Metallurgical Engineers, A. B. Parsons; National Society of Professional Engineers, Edward Larson, J. C. Riedel, Arthur Sheridan, D. B. Steinman; National Council of State Boards of Engineering Examiners, L. M. Martin.

• • •

New pipe line to N. Y. to be financed by D.P.C.

Jesse Jones, Secretary of Commerce, announced recently that the Defense Plant Corp., a subsidiary of Reconstruction Finance Corp., upon the recommendation of the Petroleum Administration for War, has agreed to finance the extension of a 20-in. petroleum products pipe line to the harbor area of New York City.

This new section, to be constructed by War Emergency Pipelines, Inc., will complete the link from Seymour, Ind., to the East Coast, and will provide for a capacity movement of approximately 235,000 barrels of petroleum products per day from the Beaumont-Houston area of Texas. Work on the Eastern section of the 20-in. line is expected to be completed by the end of this year.

Activity on the Postwar Front

Highway construction seems to lead all other activities in discussion on postwar public employment. Following are some of the highlights of current opinion and action along this line.

The American Association of State Highway Officials has told the House of Representatives roads committee that a billion dollars a year might well be spent on the nation's highways. The Texas state senate has endorsed this program.

◆

The American Road Builders Association has recently issued a study of a proposed postwar highway program. It is the most comprehensive plan for postwar construction that has been developed so far and recommends by far the largest program of highway construction ever projected for this country.

The recommendation is made that this program of highway construction be established at $3,000,000,000 per year for a period of five or six years following the end of the war. This is twice the size of the previous record highway construction program which ran close to $1,500,000,000 in 1930.

◆

Representative Beall, former chairman of the Maryland State Roads Commission, has suggested to the President that a toll highway between Baltimore and Washington be built as a postwar project.

◆

Representative J. W. Robinson of Utah has introduced a bill in Congress to authorize a 3-year federal highway program, to be effective after the war. It suggests the appropriation of $3,000,000,000 to defray the government's share of the cost, the funds to be spread equally over three years. State quotas would be determined one-half on the basis of population, one-fourth on post-road mileage, and one-fourth on area.

◆

Oregon's state highway engineer, R. H. Baldock, says that his state will get $45,000,000 from the federal government if a $3,000,000,000 postwar highway program goes through, and if the money becomes available such projects as the delayed reconstructon of the Pacific highway between Medford and Eugene, and building the new upper Columbia River highway would receive early consideration.

◆

Alabama legislature's interim highways committee has recommended to Governor Chauncey Sparks a proposal that would make possible a $6,500,000 state highway program immediately following the war.

◆

Arkansas state and federal officials have begun outlining procedure for processing plans and surveys for a gigantic postwar highway construction program, Highway Director W. W. Mitchell says. The construction program would be ready to go as soon as the war was over. If Congress appropriates $3,000,000,000, Arkansas' share would be about $16,000,000. The Arkansas highway department already has built up a backlog of more than two millions of state funds for the postwar program. Added to this is more than $1,000,000 in unspent federal funds from allocations dating back from 1941 to 1943, inclusive.

◆

A statement by John U. Shroyer, secretary of the Pennsylvania Department of Highways, predicts "An increasing need for adequate access roads to the huge airports of the future." He added that "already we are learning of the need for airplane landing strips along our state highways."

◆

Chief Engineer J. H. Dowling of the Florida state highway department believes that a tremendous amount of highway construction, reconstruction and improvements in highways and bridges will be required in Florida when the war is over.

◆

Announcement of a state-wide highway construction and improvement program to meet postwar traffic needs has met with public approval and the endorsement of motorists, it has been announced by S. C. Hadden, chairman of the State Highway Commission of Indiana. The program outlined by the commission in a report on state highway affairs to the governor and presiding officers of the Indiana General Assembly, listed construction projects having an estimated cost of $160,000,000 which would be undertaken over a period of approximately ten years.

◆

Postwar planning activities in the state of New York were further stimulated recently by the passage of legislation extending the life of the state's temporary postwar planning commission. This body, originally created in the 1942
session of the state legislature,
to function in May of last year
limited appropriation of $450,000.
The recently enacted legislation
vides for a state postwar planning
mission of seven members, four of
are to be appointed by the governo
three to be selected by the legisl
The new body will in all probability
$3,000,000 to use in the preparati
plans under this year's budget appr
tions. As things now stand, the
proposes to provide half the funds
expended in the preparation of
by municipalities under the new prog

◆

National recognition of the nece
for postwar planning and its increa
use by public and private agencies
resulted from the efforts to mobiliz
resources of the country for war, acc
ing to a report on "Wartime Plan
for War and Postwar" which has
released by the National Resou
Planning Board.

The report discloses that an estim
$7,695,000,000 shelf of federal cons
tion and improvement work was po
tially available on Jan. 1, 1943, for
postwar period. This figure comp
with an estimated volume of $6,360,0
000 as of Jan. 1, 1942, and $4,423,000
as of Jan. 1, 1941.

◆

A bill in the Connecticut legislat
has been favorably reported which wo
create a postwar planning board
pointed by the governor, to consist of
more than 15 electors. The board
cooperate with municipal planning ag
cies throughout the state, and prima
with the Connecticut Development Co
mission to anticipate and solve post
problems.

◆

Planning for construction activity af
the war so that blueprints will be rea
for actual work is occupying the att
tion of the board of directors of
Builders' and Traders' Exchange of
troit, Mich.

A five point program has been
cussed. It deals with (1) a procedu
for initiation of public construction pr
ects; (2) private projects; (3) acqui
tion of materials such as steel, etc
(4) training of skilled workmen;
better methods and relations betwe
intermeshing parts of industry.

"You cannot plan every postwar m
now," said E. J. Brunner, secreta
manager of the exchange, in commenti
on the proposed program, "but you c
get ready to move. You can bring nu
bers of projects through the bluepri
stage in various classes of work so th
when termination of hostilities comes
can be ready to do those things wh
should be done first.

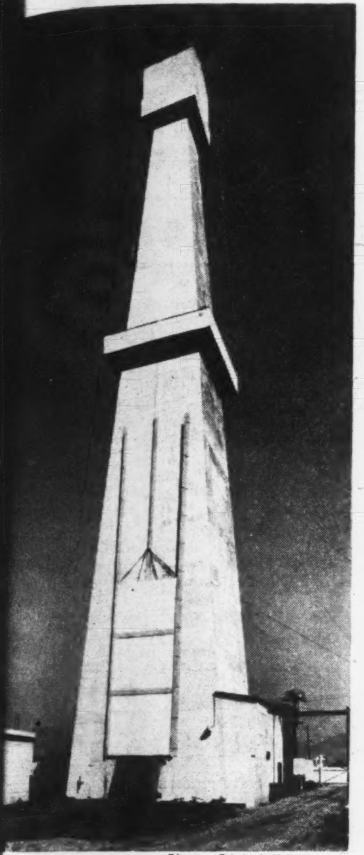


Photo Dick Whittington

Sound-proof derrick for residential area

mposition board and rock wool cover this derrick in the new drilling operation of ell Oil Company on the Verne Community ase No. 1 near the La Brea Tar Pits in Los geles, Calif. Inside this 136-foot derrick wer, electric motors drive the drilling appara-, now operating at about the 5000-foot el. This is believed to be the first time rig has been completed enclosed to protect idential and recreational buildings from ise and odor.

◆

Large additional power for Tacoma, Wash.

A 40,000-kw. addition to the LaGrande werhouse of the Tacoma, Wash., mu- cipal power system is expected to be full commercial operation by No- mber of this year, as the first unit the $18,000,000 second Nisqually wer development, Chief Engineer rne Gongwer reported recently. The al portion of the project, involving a w dam and powerhouse at Alder, is scheduled for completion until next bruary; it is now about 41 percent mplete.

JOBS OF THE WEEK

STEAM POWER PLANT, Tennessee

Defense Plant Corp., Washington, D. C., awarded contract for the construction of a large steam power plant to replace water power during dry weather period at the Clinton Engineering Works, to J. A. Jones Construction Co., Charlotte, N. C. Estimated cost is $18,000,000.

BUILDING, Massachusetts

Turner Construction Co., Boston, Mass., has been awarded contract to construct building, Middlesex County, by U. S. Engineers, Boston. Cost is between $2,500,000 and $5,000,000. Stevens, Curtin, Mason & Riley, Boston, are architects. Whiteman & Howard, Boston, are engineers. Electrical work for project has been let to Hixon Electric Co., South Boston.

ROAD, Pennsylvania

Cayuga Construction Corp., New York, N. Y., will improve 7,328 ft. Highway Leg. Rt. R-542, Section 5, Traffic R-291, Eddystone Boro, Ridley and Tinicum Townships, Delaware Co., Pennsylvania. State Highway Department, Harrisburg, awarded contract for $1,016,602.

HOUSING, Washington

Public Housing Authority, Seattle, Wash., awarded contract for the construction of 2,900 housing units, to Howard S. Wright & Co., Inc., and L. H. Hoffman, Seattle. Estimated cost is $6,600,000. Jones, Bouillon, Thiry & Sylliaasen, Seattle, are architects.

HOUSING, Pennsylvania

Public Housing Authority, Washington, D. C., received lowest bids on housing from Westmoreland Construction Co., Greenburg, Pa., $525,215; on other alternates George Dreyman & Co., New York, N. Y., was low, $523,000; $529,000 and $526,000. Schwab, Palmgreen & Associates, Pittsburgh, Pa., are architects.

STORAGE BUILDINGS, Quebec

A. Janni & Co., Montreal, Que., has been awarded contract for two 600x260 ft. storage buildings at R.C.O.C. depot, by Department National Defense (Army), Ottawa, Ont. Estimated cost, $900,000.

REFINERY, Cailfornia

The Texas Co., New York, N. Y., and Los Angeles, Calif., will convert present refinery into one equipped to produce much needed 100-octane gasoline. Project will include about forty buildings and will cost $50,000,000. D. W. Carswell, New York, N. Y., is the chief engineer. Alkylation system and feed preparation has been awarded to Foster-Wheeler Corp., Los Angeles, Calif.

PLANT, Toronto, Ont.

A. W. Robertson, Ltd., Toronto, Ont., has been awarded contract for plant, including aprons, taxiways, runways, car parks, hangars, boiler house, sewage disposal plant, fire main extension, steam supply system, road changes, to cost about $1,000,000. deHavilland Aircraft of Canada, Ltd., North York Township, Toronto, is the owner. David Shephard, Toronto, is engineer and architect.

HOUSING, Washington

B. H. Sheldon, Spokane, Wash., was lowest bidder for housing units when Everett Housing Authority, Everett, opened bids for the Public Housing Authority. Low bid was $875,900. E. W. Morrison & Associated, Seattle, are architects.

CARBON PLANT, Texas

Columbian Carbon Co., Houston, will construct by separate contracts a plant to make "black" for synthetic rubber. Present appropriation for plant is $1,225,000. Total cost is estimated at $3,000,000. M. R. Howell, Conroe, is engineer.

SINTERING PLANT, New York

Defense Plant Corp., Washington, D. C., awarded the contract to Turner Construction Co., New York, N. Y., to build sintering plant. Cost will exceed $1,500,000. National Lead Co., New York, N. Y., will operate. John E. Greenwalt Engineering Co., New York, N. Y., is the engineer.

HOUSING, South Dakota

Public Housing Authority, Washington, D. C., awarded contract for 430 family units and 288 dormitories in South Dakota, including child service center and administration building, to Northwestern Engineering Co., Rapid City, S. D. Estimated cost is $1,255,946. Lankton, Ziegele & Spitznagle, Peoria, Ill., are the architects in charge.

Note—Additional bidding and contract news on many projects large and small appear in the Construction News section beginning on page 93.

OBITUARY

Hiram S. Pelton, pioneer Milwaukee building contractor and for many years president of the General Construction Co., died in Milwaukee May 12.

Wm. H. Tamm, 77, construction superintendent of the Oakland city street department, died May 17 in Oakland, Calif.

Bret Hallock, 65, for 11 years a civil engineer in the maintenance department of the Provident Trust Co. of Philadelphia, Pa., died May 16.

David A. Keefe, bridge engineer, died at Sayre, Pa., recently. As consulting engineer of Atlantic City's steel pier, Keefe devised reinforcement methods which prevented condemnation of the structure. He also planned the shore resort's boardwalk and rebuilt many bridges of the Lehigh Valley R.R. during 40 years service with the company.

John E. Zimmerman, 69, one of the founders of the engineering firm of Day & Zimmerman, chairman of the board and former president of the United Gas Improvement Co., died in Philadelphia on May 30 after a long illness. Mr. Zimmerman graduated from the University of Pennsylvania in 1900 as a mechanical engineer and joined the engineering firm of Dodge & Day in 1907, which firm later was reorganized as Day & Zimmerman, specializing in public utility construction and management.

H. Leslie Myer, 64, vice president of the Mason & Hanger Co. and of the Silas Mason Co., died at Shreveport, La., on May 30. He was manager of construction on the Louisiana Ordnance Plant at Minden, La. Mr. Myer had been active in construction contracting since 1901, notable projects being the Hudson tunnels, Boston subways and vehicle tunnel, Mitchell and Marten dams in Alabama, pier foundations for the George Washington Bridge, Fort Peck and Grand Coulee Dams.

Paul T. Robinson, 61, formerly eng of maintenance of way and structur Southern Pacific Ry., died May Berkeley, Calif.

News of the Wee
Continued on p. 154

CONTRACTS AND CAPITAL

Civil engineering construction in continental U. S. totals $106,873,000 for the short week due to the Memorial Day holiday. This volume, not including construction by military combat engineers, American contracts outside the country, and shipbuilding, is the highest reported since the week of November 12, 1942. It compares with $46,465,000 for the preceding week, but is 61 percent below the total for the week last year.

Private construction totals $54,323,000, 51 percent of the total, and is the top figure reported since October 31, 1940. It compares with $3,654,000 for a week ago, and is 242 percent higher than a year ago. Public work is 80 percent lower than in the 1942 week.

The current week's construction brings 1943 volume to $1,598,632,000, an average of $72,665,000 for each of the 22 weeks. On the weekly average basis, 1943 volume is 60 percent below the $4,211,327,000 for the 23-week period last year. Private work, $204,089,000, is 33 percent lower, and public construction, $1,394,543,000, is down 63 percent when adjusted for the difference in the number of weeks.

Industrial building volume totals $51,565,000, the highest weekly value reported since October 17, 1940, and is the only class of work to gain over the 1942 week. Comparisons with a week ago reveal gains in waterworks, and industrial, commercial and p buildings.

New capital for construction purp for the week totals $291,000, and is m up entirely of state and municipal b sales. The week's new financing br the 22-week 1943 volume to $492,713, a total that is 92 percent lower than $6,823,307,000 for the 23-week perio 1942.

CONTRACTS

Continental U. S. Only
(Thousands of dollars)

	Week Ending June 4 1942	May 27 1943	Ju 19
Federal	$248,611	$36,371	$48
State & Municipal	10,509	6,440	4
Total public	$259,120	$42,811	$52
Total private	15,851	3,654	54
TOTAL	$274,971	$46,465	$106

Cumulative
1943.......(22 weeks)......$1,598,
1942.......(23 weeks)......$4,211,

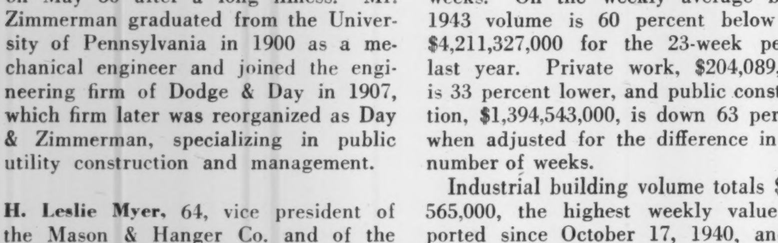
Note: Minimum size projects included Waterworks and waterways projects, $15,0 other public works, $25,000; industrial bu ings, $40,000; other buildings, $150,000.

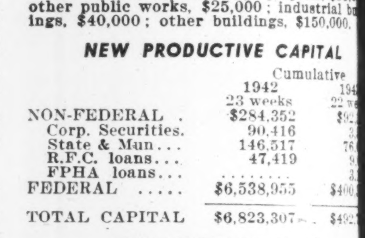
NEW PRODUCTIVE CAPITAL

	Cumulative 1942 23 weeks	194 22 we
NON-FEDERAL	$284,352	$92
Corp. Securities	90,416	3
State & Mun.	146,517	76
R.F.C. loans	47,419	9
FPHA loans	....	3
FEDERAL	$6,538,955	$400
TOTAL CAPITAL	$6,823,307	$492

ENR INDEX NUMBERS

Index Base = 100		1913	1
Construction Cost	June '43	289.94	139
Building Cost	June '43	227.71	123
Volume	May '43	203	89





Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

ostwar Thinking

Sir: I was much interested in the o editorials appearing in the May h issue, the first one, "Don't Bring Back"; and the second one, "Post- ar Fact and Fallacy." These two litorials, besides being of technical terest, it seems to me are also of eneral public interest.

The first one, "Don't Bring It ack," has a double value for our ostwar plans. First, it certainly is a ery effective plan for advertising e United States and its technical uipment and abilities, and not too pensive a plan even if the equip- ent is given away and written off the war effort. The many articles hich appear in your magazine and hers show clearly that even in re- ote countries, in many instances e natives quickly took to the use of ch mechanical equipment.

This brings me to the second point, hich is, the stated purpose of our esent administration to improve e standard of living all over the orld. Once people in other coun- ies see by a practical demonstration, which many of them take part emselves, of what can be done with e equipment that we have sent to ese countries, there is unquestion- bly created a desire to be given an pportunity to use more of such uipment for the purpose of improv- g their condition. This is a far ore substantial. solid and perma- nt way of raising standards of liv- g in other countries than the pater- listic and many times demoralizing tempt of raising the standard of liv- g in other countries by giving them ee food and free clothing (at the pense of the American tax payer).

Your second editorial—"Postwar ct and Fallacy"—puts emphasis on other important problem of post- ar planning, and also puts its finger a weakness in the attitude of the erage American in regard to post- ar planning. We are very good at eating things; we have imagination d the courage to push things rough against obstacles, but we nerally dislike the unromantic work of carefully planning and scheduling, particularly if it has to be done for a considerable period ahead. This attitude is quite typical and can be illustrated by an answer a doctor once gave me when we were commenting on the readiness of surgeons to operate. The doctor, not a surgeon himself, defended the surgeons by saying that the fact that so many operations are resorted to in the United States is not so much due to the anxiety of the surgeons to operate as to the impatience of the patients to submit to a slower, but very often just as effective a method of treating the difficulty by medicine instead of by cutting. It is this impatience that can lead us into serious difficulty in postwar planning, and I think your editorial is a good start in emphasizing the necessity of careful and painstaking planning, which, of course, in turn calls for substituting patience for our ingrained impetuosity in getting things done.

E. J. Amberg
Waterbury, Conn.

Road Machinery

Sir: I was very much interested in the editorial appearing in the issue of May 6, p. 664, concerning road machinery.

Let me say that I agree with you thoroughly that every particle of road machinery that goes abroad should stay there for the reasons which you mentioned. In the first place, I think most of it will be pretty well worn out and, in the second place, we have a wonderful opportunity to put into manufacturing practice all that we have learned in the way of accomplishing better techniques in the building of all kinds of pavements and structures. This is nowhere more marked than in the asphalt paving field where the modern mixing equipment and spreading machinery have partially revolutionized the art of such construction.

I am not quite sure that we made a mistake last time in distributing the surplus war equipment to the state highway departments. I happened to be with the U. S. Bureau of Public Roads immediately after the last war and later as division engineer and maintenance engineer in West Virginia. I believe that a number of the states, who were then just starting their highway organizations, were able to get into an operating condition as the result of having this surplus war equipment, whereas they might have been delayed for several years before their income would have permitted the purchase of such equipment.

I know that I received a large number of trucks, distributors, heating kettles, forges, and a great variety of small tools which enabled me to quickly put a substantial mileage of roads in a good condition and thereby gained the approval of the people of the state in supporting the extended operations of the State Highway Department. We are apt to forget that in the early twenties there was considerable opposition in many states, from the county authorities, to having the state take over a certain percentage of highways for state control. In fact, that so many states were able to make such an excellent showing in so short a time was due, to some extent, to the availability of the large amount of construction equipment which otherwise they would not have been able to purchase. However, this condition does not prevail at present, and again let me say that your editorial is worth repeating from time to time as we should leave this equipment abroad and start our reconstruction in this country with brand new equipment.

Bernard E. Gray,
General Manager,
The Asphalt Institute,
New York, N. Y.

★ ★ ★

City still paying on Civil War ransom

The town of Frederick, Md., after 78 years, still is paying off the $200,000 ransom it borrowed from a bank to turn over to a Confederate general who threatened to burn the town if the city did not comply with his demand. As reported by the Public Administration Clearing House, the city has paid $331,000 in interest alone to the bank that furnished the ransom money and will not complete payments until 1951.

EDITORIALS

VOLUME 130 NUMBER 22

June 3, 1943

For the Day Ahead

New horizons for water service, which are explored in a 16-page report in this issue, direct attention to postwar planning for one of our vital public services. Of special interest is the evidence cited from a survey of manufacturers, which reveals that little in the way of newly-developed equipment and materials should be expected when the war terminates. This provides the strongest argument for undertaking advance design and specification writing now; many municipalities have been hesitant in this respect, believing that revolutionary changes in waterworks practice and equipment were in the making that would outmode plans based on present information. The report also analyzes deficiencies in physical facilities and in administrative and legal policies, the correction of which might form the basis for postwar objectives. To this end the report should serve as a stimulus in drafting a program of action for the days ahead.

A False Sense of Security

Records are made only to be broken. That statement is just as true with respect to floods as it is on athletic fields. During the recent floods in the Midwest a record at Ft. Smith, Ark., that has stood for more than a century was broken, as were other records of long standing, this despite the fact that some flood storage reservoirs have been built at the headwaters of the Arkansas River in recent years. All of which serves to draw attention to the fact that on large rivers record floods may be produced by abnormally high rates of rainfall over only part of the watershed if regulation of the river's flow is not fairly complete. Complete regulation of many rivers is not practical. Floods due to heavy rain over a limited area can be checked if the fall is upstream from the reservoirs that have been built on tributaries of a large river; however, if the fall is downstream, the reservoir is of no avail. In fact, if the reservoir serves to flatten and lengthen the crest of a flood due to an earlier rain over its watershed it may add to the crest on the lower river due to additional floodwaters from uncontrolled tributaries. Hence, provision of a limited amount of flood storage at the headwaters of a stream may create a false sense of security in the valley below. Floods of the past weeks should serve as a warning to the inhabitants of the valleys of other river systems in this country that are only partially regulated. There is no rainfall record that may not be exceeded; there is no unfavorable combination of floods from tributary streams that may not be surpassed. Under these circumstances, flood precautions for cities in these river valleys cannot be relaxed.

Space for Plant Layout

Adequate room is the first requisite of an ideal layout for the plant required for any construction operation. Yet the tendency too often is to make a yard compact in an effort to save ground rent or to reduce job transportation costs and time. The lack of economy in such practices is particularly apparent in wartime shipbuilding, where large areas are required for prefabrication work. One of the outstanding features of the efficient yards for ship construction, described in recent issues, is not only the ample space devoted to work and storage areas, but also the provision of space for expansion or for the introduction of new processes. Although large areas may be more important in shipbuilding than in other types of construction, there is nevertheless a suggestion here for jobs of other kinds. Room to maneuver, to expand and to work is important on any construction operation.

Not Part of the Grand Strategy

Army engineer troops in training in camps in the South were called last month to fight an enemy not on the schedule of the United Nations—floods. The record they made is good reading (*ENR*, May 27, p. 770). This was due in part to fine physical condition of the soldiers and to their training to work as a coordinated group; it was due also to foresight on the part of someone high up in the Corps of Engineers. Realizing that a major flood in the lower Mississippi valley might breach the levees and flood war plants, the corps set up a flood-control center in the Engineer Unit Training Center at Camp Claiborne. This center got daily reports of gage reading on the Mississippi and supervised the training of a few men in the use of sandbags to reinforce levees, the technique of using sandbags for that purpose being somewhat different from that of their use in repairing shell holes in roads. When flood waters began to rise to erous heights against levees along the Arkan- hese officers and men were dispatched to that n together with some of the engineer regiments aining at Claiborne. They soon found that had a real fight on their hands, though the y was quite different from the one that they trained to meet. They were successful in saving many thousands of acres from overflow. But of all, the job gave the regiments an oppor- y to operate under emergency field conditions will be of inestimable value to them when take up their war jobs on far-flung foreign s of action.

tasy of the Far North

D AN ELEVATED railroad to Alaska instead of her highway, suggests Secretary of Interior old L. Ickes. "Build it all the way across so they would not have all this trouble with snow ice and bogs and all that sort of thing." One d be cynical about such an idea and suggest the Alcan Elevated be supported by skyhooks, it is perhaps more constructive to point out a of the disadvantages of the Secretary's scheme, make a counter-proposal. In the first place, not so much snow and ice as intense cold that pers overland transportation to Alaska; and cold cannot be escaped by moving a few feet ard any more than a Kansas cyclone can be ded by moving a few feet windward. Further- e, elevated railroads depress property values g their routes and leave blighted areas and s in their wake—which suggests a bleak out- for Mrs. MacIntosh's Indian trading post in Yukon, Jean Jacquot's beautiful hunting lodge luane Lake, and the sprawling Indian village anacross, Alaska. Now, a subway—the Alcan ay—would have none of these disadvantages. truction difficulties? Nothing to it for shield el drivers like Jack McDonald, master of East r's treacherous bed and Harvey Kruse, con- or of Detroit's and Chicago's tricky clays. of all, no critical materials would be required the lining; using concrete block lining tech- e, ice blocks from Eskimo igloos, already cut ape and size, would prove ideal. Ventilating ,800-mile tunnel? Nothing to that, either. ly pipe the exhaust from Washington, D. C.— adequate pressure reducing valves, of course, otherwise southbound trains couldn't operate against the gale. Time's awastin'. Let's get going on the Alcan Subway!

Postwar Bridge Standards

THE LARGE NUMBER of substandard highway bridges, which surveys repeatedly disclose, suggest a field for postwar planning that is of nationwide importance. Even those structures designed for the standard 15-ton truck-train loads (H-15) can well be critically examined in the light of future highway traffic development. The fact that such design loads have been common for twenty or more years should in itself make them subject to question in so far as their continued [illegible] on the main network roads of the future is concerned.

Some state highway departments now are using an H-20 loading in the design of structures called for in the reconstruction of main roads. Increased design loadings do not greatly raise costs, only slightly larger substructures and moderately stronger floor systems and main members being required. Furthermore, since the proportionate cost of bridges is usually small, any highway project can well afford to include adequately strong structures.

Deck width is another matter that should not be overlooked in developing new designs. The theory that 24-ft. bridge roadways can safely accommodate traffic on a 30-ft. highway has been amply disproved. Not only does the narrowing at bridges create driving hazards and greatly retard traffic flow, but the cost of widening these bridges that prove to be hazards or bottlenecks is high, being out of all proportion to the saving in first cost over the cost of a wide bridge for all but some long-span structures. An outstanding example of what the trend in bridge deck widths might be is the design used on the new Detroit Expressway where the full shoulder width is included in the deck (*ENR* Jan. 14, 1943, p. 60).

Bridge construction has seldon kept pace with highway development. Right now is the time to start designing bridges strong enough and wide enough to meet future demands. Bridge engineers of the state highway departments have an unprecedented opportunity to develop designs for postwar structures that will be free from the shortsighted mistakes of past years.

INEERING NEWS-RECORD WALDO G. BOWMAN, *Editor*

Copyright, 1943, by McGraw-Hill Publishing Company, Inc.

RD J. CLEARY, *Managing Editor. New York:* V. T. BOUGHTON, A. N. CARTER, H. W. HUNT, E. R. DENMARK. *Chicago:* H. W. RICHARDSON,
R. CARR. *Washington:* PAUL WOOTON, R. B. COLBORN. *San Francisco:* N. A. BOWERS. *Consulting Editors:* F. E. SCHMITT, W. W. DeBERARD
TORIAL OFFICES: 330 WEST FORTY-SECOND STREET, NEW YORK, N. Y.

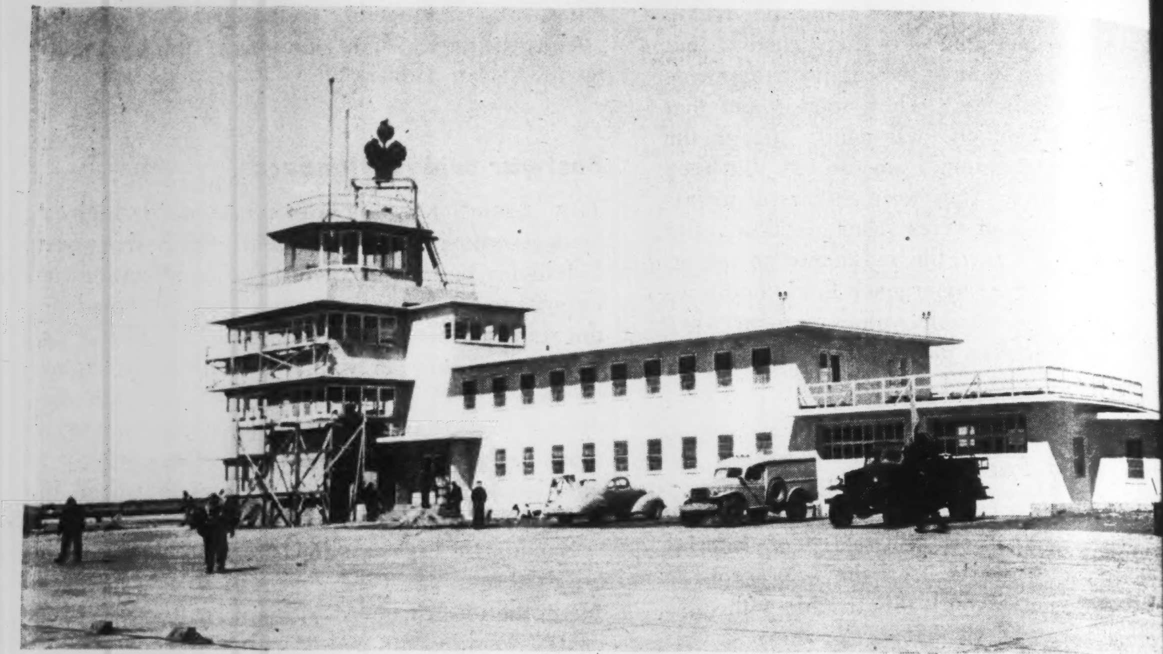


Fig. 1. Concrete framed control tower has cantilever floors to give full visibility of flying field.

Special Expedients Speed Construction of Naval Air Training Station

Contents in Brief—*Much of the training of Naval air cadets is being done on inland fields rushed to completion so as to be ready to serve the first graduates of the preflight schools. To meet this deadline and save critical materials, too, required ingenuity in both design and construction. Timber, concrete and second-hand steel had to be used. Field-made laminated wood arches, columns and truss chords were substituted for heavy thick timbers. Landing mats were laid to natural contours, saving grading and drainage. And, buildings were given neat finished appearance by standard wall boards in a variety of materials and patterns. Eighteen comfortable, attractive and efficient stations are now in use.*

FAR FROM THE SEA and the airplane carrier decks that will be their eventual home, thousands of pilots are being trained for the Navy's fleet air arm. Operating from runways and landing mats that only a few months ago sprouted corn or wheat, cotton or buffalo grass, these patriotic and adventurous youngsters are enjoying living, schooling and training facilities of a character and efficiency that are outstanding, even in these days of construction miracles. Built of noncritical materials that were often not of conventional quality, and built with labor that was always too small in numbers and frequently lacking in experience, these airbases present an appearance of permanence that completely hides their temporary and emergency character. Everyone who has seen them agrees that they represent one of the most notable achievements of the many that have been chalked up to the credit of the Navy's Bureau of Yards and Docks and its civilian engineers and contractors.

Within a period of about six months, eighteen of these primary air training stations have been built, all but a half-dozen in the Middle West. They form a part of a vast schooling system directed from the headquarters of the Naval Air Primary Training Command at Kansas City. First step in the schooling is taken at five preflight schools established on university campuses in Georgia, North Carolina, Iowa and California. The primary air training centers are the second step, while the final training comes at the advanced schools at Pensacola and Corpus Christi.

Significant fact is that establishment of the preflight schools and inauguration of construction of the primary air training stations were simultaneous, and since the preflight course is only three months, men were ready for flight training before the bases were finished. Landing field facilities were built first, and flight training has, therefore, been going on as construction proceeded. This visible incentive to get the base installation finished has been a big factor in the fast progress made.

Facilities provided at all of the pri- ary air training stations are identi- l, but construction and design prob- ms vary somewhat, depending upon pography, soil, availability of ma- rials and labor. Also, considerable titude in altering standard designs meet special conditions was al- wed the officer-in-charge and the rchitect-engineers. The result is that ll stations, as built, are not identical n construction details, and that some tations progressed faster than others.

Typical station facilities

One of the outstanding jobs, lo- ated almost at the geographical cen- er of the United States, exemplifies n its facilities and in the solution of he design and construction prob- ms, the character of this whole Navy pilot training enterprise. There re concrete runways, huge bitumin- ous landing mats, barracks, hangars, operational and recreation buildings, a hospital, mess halls, a large enclosed swimming pool, a drill hall, gasoline and water storage tanks and a sewage plant. None of these facilities is radically different from similar facilities at other war installations, yet each involved some design or construction element or expedient in design or construction that was special, interesting or instructive. The more important of these are worth recording.

The most readily apparent characteristics of this naval air station on the prairie are the exclusive use of flat-roof buildings and the pleasing variety of architectural treatments of exterior walls, achieved with cement-asbestos sheets and shingles. Wide eaves serve as sunshades on all buildings, whether one or two stories, and emphasize the flat roofs, which architects feel integrate the buildings with the surrounding level country. Cement-asbestos shingles are the most prevalent exterior wall covering, but where large shingled areas would become monotonous they are broken up by bands of smooth cement-asbestos board. Variation in the smooth surfaces is sometimes introduced by using battens over the joints. The walls of the recreation building have a band of smooth sheets around the bottom, then a band of rustic wood siding, set vertically and painted white, and are topped out with shingles. The light gray sheets, the white boards and the darker gray shingles produce a pleasing contrast. Similar contrasts are obtained in other buildings by painting the window and door frames white.

Another variation in appearance results from enclosing some of the buildings, such as the heating plant, and the fire station and the garages, with brick. Principal reasons for using brick were to diversify the labor force and to utilize a local material that was available at reasonable cost.

Unusual variety of framing

The many types and sizes of buildings required in an installation of this kind naturally result in various kinds of framing. Except for the airfield operations building, which is of reinforced concrete, and the heating plant, which is of structural steel, all framing is of timber. Short span buildings, such as the barracks and the hospital, are framed with columns and rafters. In the barracks, two stories high and three bays wide, laminated columns carry laminated beams running lengthwise, while the rafters frame transversely. Column-to-beam connections are made by scab boards either side, extending to the tops of the beams; diagonal braces are also used. The rafter connections to exterior walls are strengthened by deep knee braces. Use of laminated columns and beams solved the problem of unavailability of large solid timbers.

Mess hall and hospital framing form an interesting contrast because, although quite different, they have a similar finished appearance, after the inside surfacing of ½-in. gypsum board is applied. The mess hall, because of slightly longer spans, is framed with transverse trusses supporting longitudinal rafters, while in

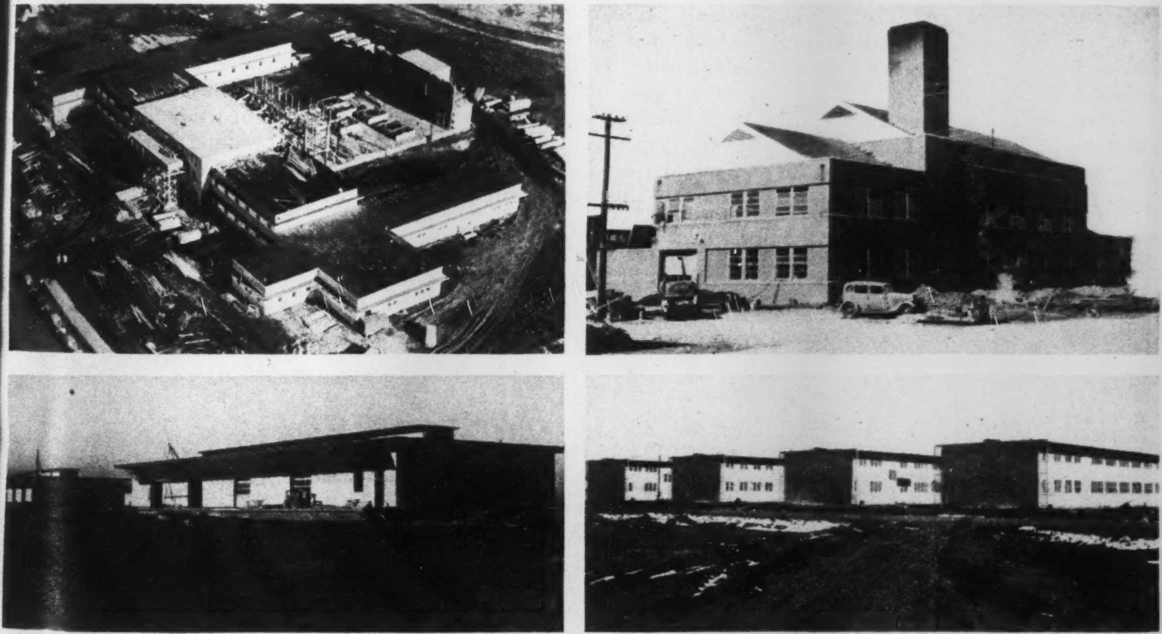


Fig. 2. Buildings at the station are of wide variety of types, but all have flat roofs except the power plant (upper right); second-hand steel roof trusses provide it with a gable outline. Other buildings shown are the auditorium and recreation hall (upper left), a typical wide-eaved warehouse (lower left), and enlisted men's barracks (lower right).

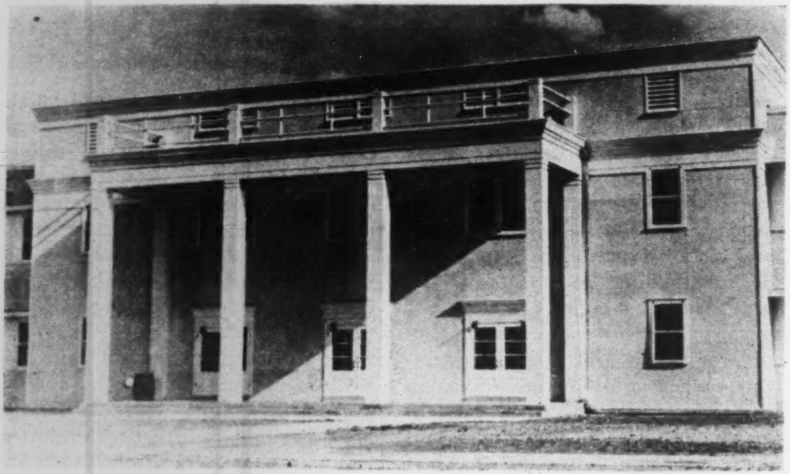


Fig. 3. Contrasts in materials give the entrance to the recreation hall a distinctive appearance. Wood portico and trim contrast with smooth cement asbestos board, while to right and left begin horizontal bands of cement-asbestos shingles alternating with rustic wood siding painted white.

the hospital, rafters run transversely from wall to wall, being trussed with king post bracing to carry over the 25-ft. span. Since this latter construction, however, is not rigid enough, transverse wind trusses are introduced at intervals. These trusses carry no vertical loads, as do those in the mess hall, but this is not apparent to the observer in the completed building. Another building in which the framing is covered by interior trim is the recreation hall or auditorum; the ceiling is hung below the bottom chords of 73-ft. span Pratt wood trusses, and kneebraces at the first panel points are covered to match the walls.

All of the above buildings are insulated with rock wool bats, 4 in. in the roof and 2 in. in the walls. The 2-in. bats are centered in the 4-in. thick walls, so that an air space is provided either side. To ventilate the roof and thus reduce possibility of condensation on the bats, screened openings are provided under the eaves between each pair of rafters. Painted white, the screens are almost invisible except on close inspection.

Using sub-grade timber

For such structures as the hangars, recreation building, repair shops and the swimming pool, relatively long span—75 to 120-ft.—trusses, are required. Although these trusses are conventional as to design, they presented some special problems in the field because of a shortage of long, thick timbers, and because all the lumber was very green. As a result of the first condition, 3-in. thick timbers were often made of three 1-in. boards glued together, and a cho might have solid timbers for part its length and laminated members f the remainder. It was the use of su expedients as this that got the jo finished on time.

The green condition of the timbe coupled with general poor qualit was particularly troublesome in th 120-ft. span hangar trusses. Th standard design for these trusses us members proportioned on a 1,400-l unit stress basis, but this was considered unsafe for the existing conditions, and critical members wer increased in section until the actu design stress was more nearly 1,00 lb. per square inch.

As an example of this trus strengthening, a web member of tw timbers, framed inside the chor might be shown on the standard design, but this would be increased to four-timber member by adding timber to each side, framed outsid the chord. The green condition of th timber was principally troublesom in requiring frequent tightening o the truss bolts as buildings dried out.

All of the trusses were fabricate at the site, using split ring connector at the joints. Gusset plates were no required, except at column-to-trus connections and at a few joints in the longitudinal trusses on the centerlin of the hangars that carry the ends o the 120-ft. span transverse trusses. Here, where a relatively large number of members converged at a joint, steel gussets were necessary. Several of them are unusually large, filling a sizable proportion of the panel, a condition resulting from the juxtaposition of wood and steel. For example, in the wood members, bolts are rela-

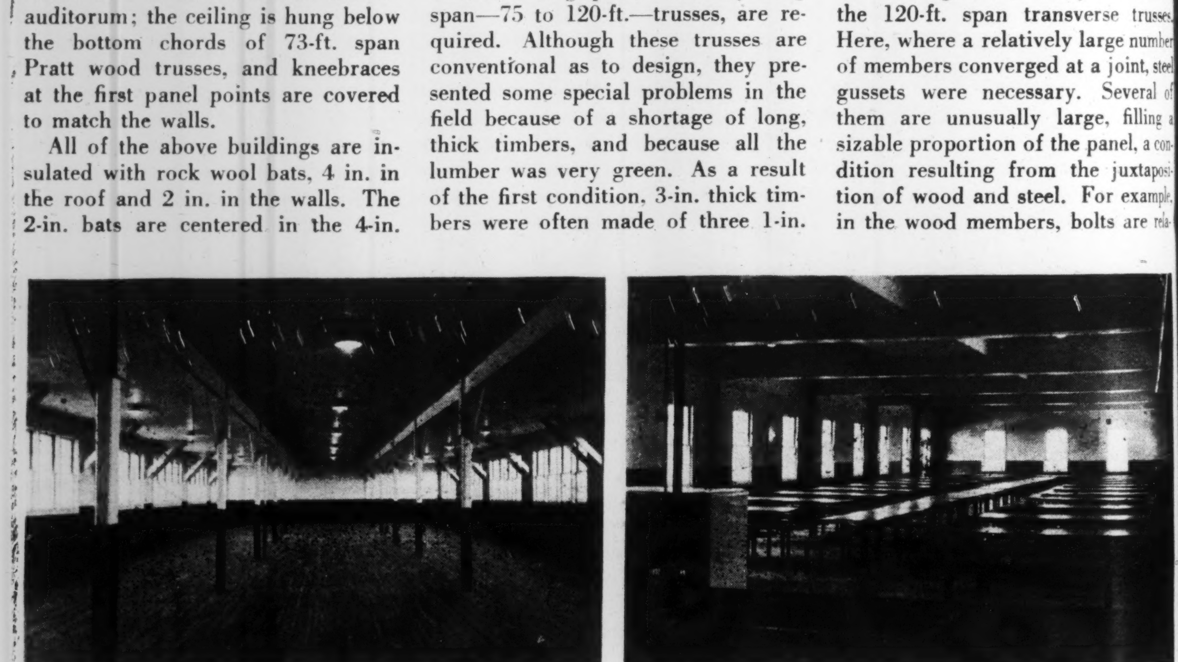


Fig. 4. Typical interiors illustrate use of non-critical materials. Barracks framing (left) consists of laminated wood columns and beams, while wall covering is fiber board to window level and gypsum board above. Same covering materials are used in mess hall, where gypsum board also encloses trusses, columns and air duct.

ively far apart because each is surounded by a 4-in. dia. annular ring onnector, and this spacing of bolts n the steel, where loads must be ransferred in shear on the bolt shank, equires a long connection and thus large steel gusset plate.

Roofs of the hangars are covered ith 2-in. thick gypsum plank, made p of four ½-in. laminations, half of hich are offset to provide for lapping at the joints. Some of these lanks are used to span as much as 3½ t. The top layer of the plank comes quipped with a covering of waterproofed paper, and a bonded asphalt oofing is applied over the deck in the eld. Similar asphalt roofing is used ver the timber decks of the other uildings. All of this roofing is carried down over the edges of the eaves, here it is tacked with a horizontal wood strip, a detail that is both economical and weathertight, and is also useful in deflecting roof drainage away from the building walls.

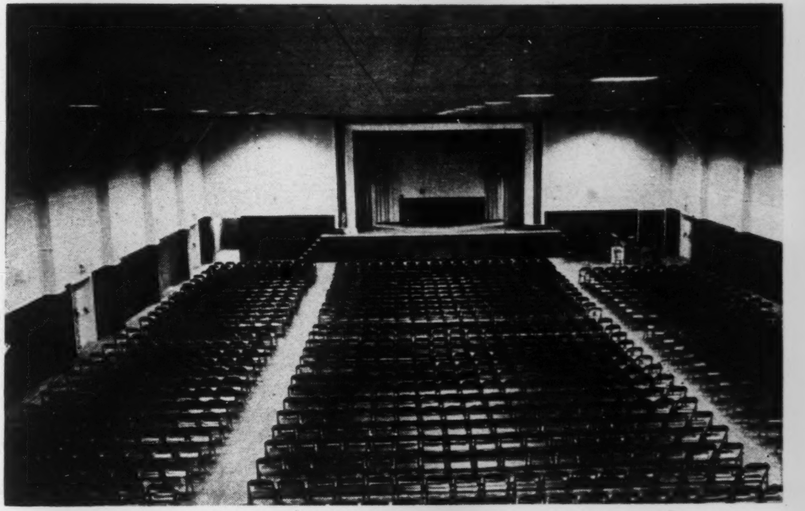


Fig. 5. Gypsum, asbestos and fiber boards afford a variety of finishes in the auditorium. Above the ceiling the roof is framed with 73-ft. span timber Pratt trusses whose connection to the columns is rendered rigid by kneebraces.

Special steel and concrete buildings

Two other buildings at the station, the boiler plant and the control tower of the operations building, involved interesting considerations, the latter because of its reinforced concrete cantilever floors and roof, and the former because of its use of second-hand materials and equipment. Because the boiler plant was a high, wide-span structure, it was desired to build it of steel. New fabricated structural steel being unavilable on this project's priority rating, the officer in charge instituted a search for second-hand steel. An abandoned factory with roof framing of suitable size was located in a nearby town and, using this as a nucleus, a boiler plant was designed in the field. As finally built, the boiler plant not only uses second-hand truss framing, but most of its boilers and appurtenances are also second-hand.

The control tower is probably the only building at the station whose original design was not compromised in one way or another. Of reinforced concrete, about 30 ft. square and four stories high, it is framed so that the occupants can have a clear view of the flying field, which surrounds it on three sides. A basic requirement was elimination of corner colums in the first three stories and elimination of all columns on the three operating sides in the top story. Columns, therefore, are placed in the center of the four walls, with the second and third floors cantilevered to the corners. All but one of these columns are discontinued at the fourth floor. In their place, to support the roof, a two-column bent is introduced near the center of the building, supported on a beam in the fourth floor. The roof is cantilevered to the walls over this bent, the single wall column that was continued from the ground serving as an anchor. Stressless, or perhaps subjected to a slight tension in the initial construction, this column is now efficiently stressed in compression by virtue of a 4,000-lb. beacon installed on the roof in a location as far back on the anchor arm as possible. Not only is a strong rigid roof provided by this arrangement, but the desired elimination of wall columns on the three operating sides is achieved.

Field-made laminated wood arches

Although the majority of the buildings required some measure of ingenuity in their construction, none

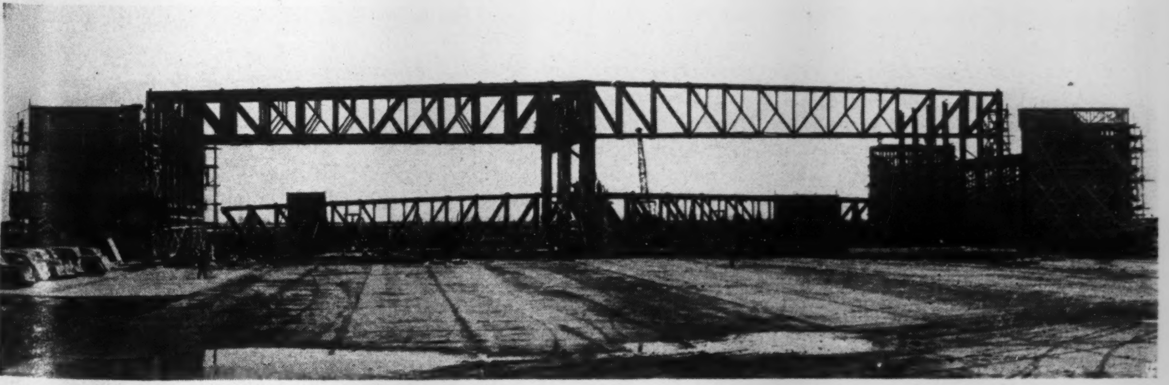


Fig. 6. Erecting 120-ft. span timber trusses for one of the hangars. Only low stress-grade timber being available, extra section was added to all critical members, which accounts for heavy appearance of trusses.

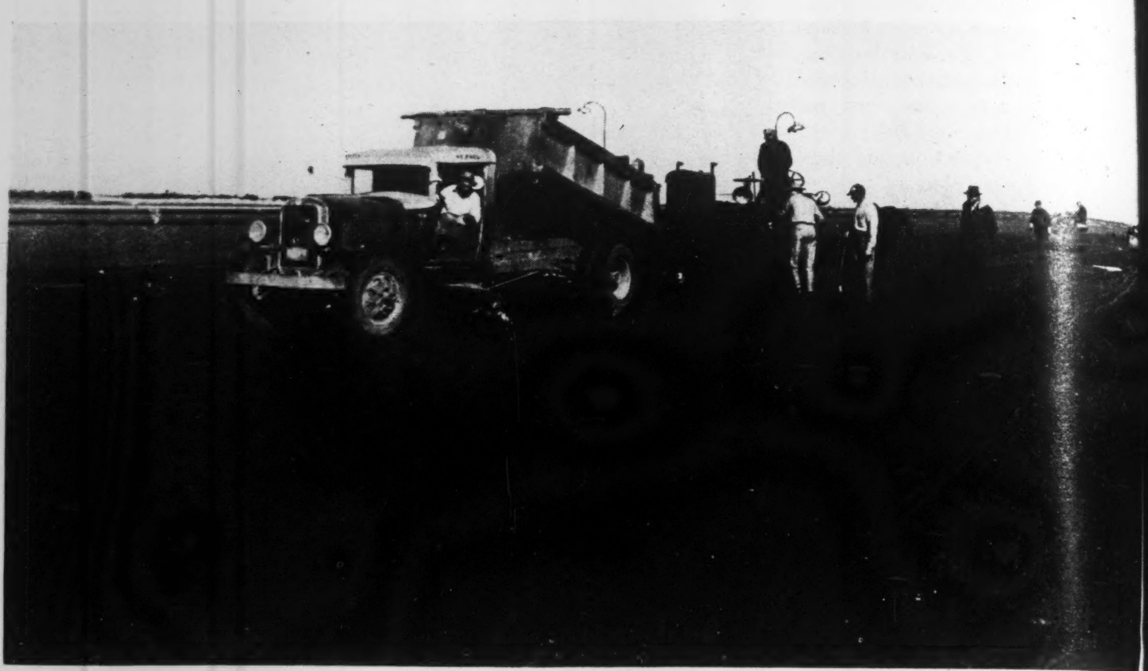


Fig. 7. Many hundreds of thousands of square yards of asphalt landing mats were laid on the training field, for the most part to the natural contours, without resorting to any grading. This type of construction, which was possible because of the light planes to be used, also eliminated any need for artificial drainage facilities.

was as outstanding in this respect as the drill hall. This building, of the type described in *ENR*, Jan. 28, 1943, p. 124, is framed with 120-ft. span, $7\frac{1}{2}$x32-in. laminated arch ribs, which it was contemplated would be purchased as shop-fabricated members. Best delivery possible, however, involved a wait of 60 days, and the contractor decided he could save time by fabricating them on the site. As it turned out, the last rib of the drill hall was erected before the time that the first shipment of purchased, prefabricated ribs had been promised.

The equipment and procedure used to effect this field fabrication of glued laminated arches are of more than ordinary interest. For his fabricating shop, the contractor used the job carpenter shop, a building 160 ft. long and 28 ft. wide. One end of the shop was set aside for assembly of the arches in halves, while the other end was devoted to fabricating the 82-ft. long laminations by glueing the scarfed ends of 2x8-in. boards together. Outside this end of the shop a heated drying building was built where the boards were stored until their moisture content had been reduced below 15 percent.

Operations began by scarfing the boards, after which they were placed in the drying building, and then moved onto racks along one side of the shop. Adjacent to these racks, in the center of the building, platforms were set up upon which scarf glueing operations were carried out. The scarfs, 18 in. long, were brush-glued and then clamped in groups of three for a period of 18 hours. Removed from the clamps, the 82-ft. long laminations were stored on the other side of the building ready for the assembly operations.

Assembly of the half-arch ribs was carried out around a series of timber jackframes set on the floor and following the curve of the arch. As a lamination was pulled from the storage racks at the far end of the building and moved down to the jackframes, it was slid across a roller mounted in a glue pot, an operation that thoroughly coated the surface. Set vertically against the jackframes, it was then held in position by pins at either end and a nail to the jackframe at the center, while another lamination was brought into position. This was set against the previous lamination, and the process repeated until the twenty laminations of the rib were in place. The pins at either end were moved outward in a set of graduated holes as the laminations were progressively applied.

As soon as the last lamination was in place, clamps were installed around the rib at 1-ft. centers (four between each pair of jackframes) and left on for 12 to 16 hours. Since the ribs were usually within $\frac{1}{2}$ in. of their compacted thickness, not much pressure was required from the clamps. As shown in Fig. 9, the jackframes accommodated two ribs at a time, one on top of the other.

After the required setting time had elapsed, the ribs were moved out of the building on a curved track laid to the radius of the arch. With this fabricating method, a minimum of two half-arches were completed every 24 hr., and the entire arch requirements were thus met in about twenty days.

Job-built heat ducts

The large saving in critical materials on this job extended also to the heating systems, which consist of ducts supplying heated air from steam coils located in the various buildings and connected to steam lines from the boiler plant. The ducts, in a large variety of sizes, were built on the job, of cement-asbestos board placed within light wood frames. Outlet ports consist merely of small sliding doors of plywood, which can be opened or closed with a hooked ick or ordinary window pole. All ir returns are through wood grills the floors, the underfloor space erving as a large plenum chamber.

Storage of aviation gasoline is in nderground tanks, in accordance ith usual practice, and the tanks sed are of the prestressed concrete pe in which the shell is built and e forms stripped before the circumerential rods are installed, preressed end encased with the outer ell section, usually of shotcrete.

A particular problem that has been ncountered in such construction is e difficulty of holding the circumerential rods in an exact horizontal lane during prestressing. This probm was solved on this job by nailing lf $\frac{3}{4}$-in. rounds to the forms, thus oring the surface of the concrete at e locations of the prestressing rods. effect, this furnished a series of helves that supported the rods in a ue circle in a horizontal plane. More niform prestressing and faster progess are said to result. This construcion is shown in Fig. 8.

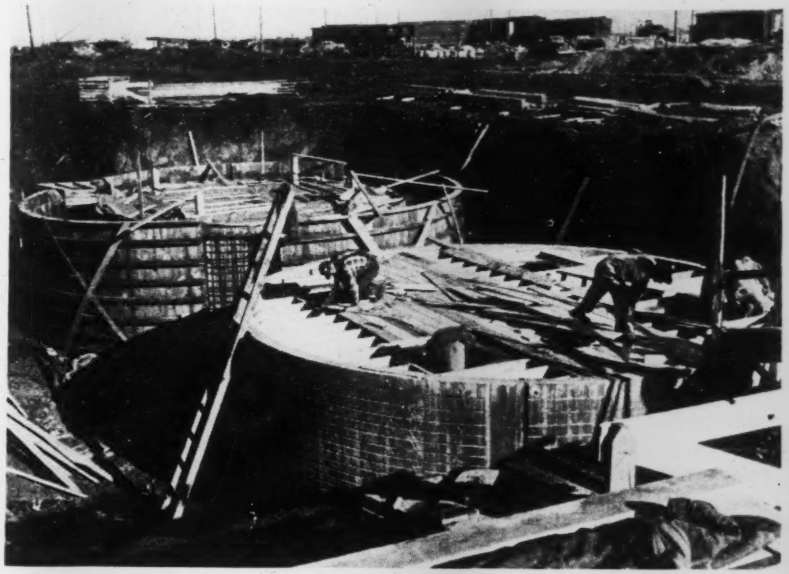
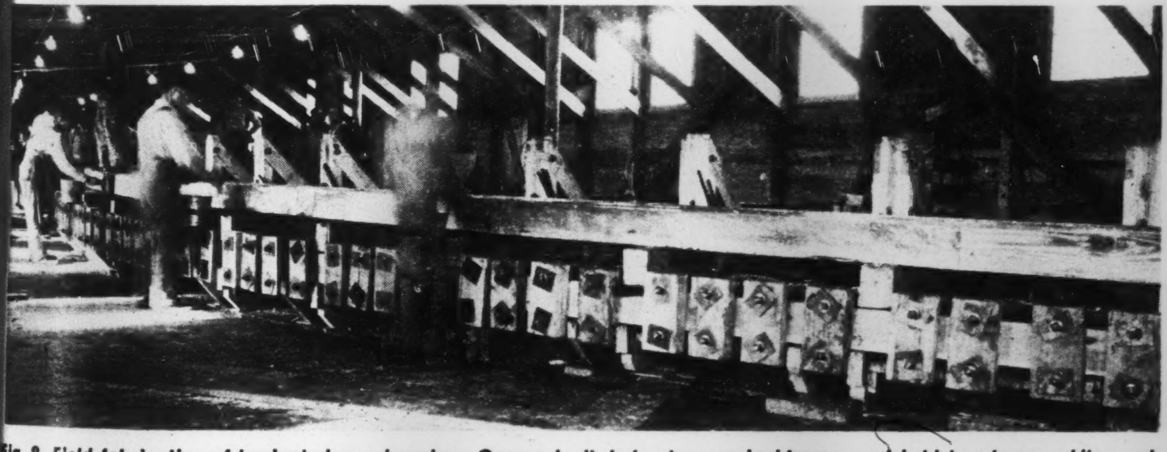


Fig. 8. Prestressed concrete tank construction was speeded up by forming grooves in the surface to hold the circumferential rods in a horizontal plane while the prestress was applied. The above construction view shows these grooves, as well as one of the vertical chases that accommodate the turnbuckles on the rods.

Airfield construction

Several elements of the airfield at his training station are noteworthy, lthough the construction operations ere for the most part routine and onventional. Subgrade preparation or the vast expanse of paving reuired only 500,000 cu. yd. of gradng. For the landing mats, as a mater of fact, the only preparatoin was o roll the surface thoroughly, after hich the comparatively thin layer of sphalt was laid down, a design that as satisfactory for the light training lanes that would use the mats. Not only was this operation inexpensive in itself, but by laying the mat to the existing ground contours natural drainage channels were maintained, eliminating the necessity for a costly drainage system. Using the output of four job asphalt plants, as much as 35,000 sq. yd. of mat was placed per day with three paving machines. Paving of the concrete runways and warming-up aprons did not involve other than conventional procedures. Materials were batched at a central plant and trucked to the highway pavers which moved along outside the forms, depositing the concrete from a bucket on a boom. Steel forms were used for this construction.

Design and construction supervision on this naval air training station were in charge of the Navy's Bureau of Yards and Docks, of which Rear Admiral Ben Moreell (CEC) USN is Chief. Officer-in-Charge of Construction was Lieutenant Earl G. Dobins, (CEC), USNR. Architect-engineers were Black & Veatch, of Kansas City, Mo., represented by Riley D. Woodson and Edward A. Farmer, while the contractor was Peter Kiewit Sons' Co. and George W. Condon, of Omaha, Nebr., for whom Henry Ohlsen was project manager and Gordon Shattuck, assistant project manager.



ig. 9. Field fabrication of laminated wood arches. One arch rib is in place on jackframes and held by clamps while workmen put glue on a lamination of another rib being assembled above it. The ribs remained in the clamps and frames for 2 to 16 hr., after which they were removed from the shop and taken to the nearby drill-hall site of erection.

Bringing a Bridge Up to Date

***Contents in Brief**—Traffic requirements and the need to rehabilitate the deck of a Pittsburgh bridge called for widening of the existing roadway, the installation of improved expansion dams and addition of combination curb and splash guards. Repairs also included the construction of special non-clogging type catch basins.*

SOLUTIONS to four major problems make recent repair of the Liberty Bridge at Pittsburgh of special interest. Not only did the roadway of this Monongahela River crossing have to be repaved and widened, but the expansion dams had to be improved to eliminate objectionable bumps at those points. In addition, non-clogging drains had to be provided and a satisfactory combination curb and splash guard developed.

Completed in 1927, the Liberty Bridge is a high deck-cantilever structure with the trusses 43 ft. 6 in. center to center. The crossing originally provided a 38-ft. wide bituminous concrete roadway of 5 in. minimum thickness and 3-in. crown. In winter, ice and snow at the curbs reduced the roadway width to about 36 ft., which was too narrow for four lanes of heavy traffic. As a result, when a new slab had to be added, plans also provided for widening the roadway to 40 ft. by reducing each sidewalk from 8 ft. 6 in. to 7 ft. 6 in. Also the crown was to be increased from 3 to 4 in.

To increase the roadway width, the problem arose as to the proper support for the outer edges of the roadway and the inner edge of the sidewalk. Where the top chord was of box construction, the plans provided that the new roadway slab be supported on the outer floor stringer. The new concrete curb was placed directly on top of the chord member and projected under the sidewalk to support the inner edge of this slab, as shown at the top of Fig. 2. This design proved very satisfactory and was used for about 3,600 ft. of construction.

Center strip proves effective

Where the top chord consisted of eye bars the roadway was supported as before, but the new curb rested on haunched concrete along the existing curb stringer. This support was more costly per lineal foot and required more difficult work, but proved a good solution to the problem. The detail of the support also is shown by Fig. 2. In constructing the new roadway slab a continuous 9-in. wide raised medium strip of white concrete was added along the center line. This strip has a 3-in. crown and the slight rise offers a barrier that has proven very effective in controlling traffic. The two lanes each side of the center line are separated by alternate 5-ft. lengths of black and white concrete.

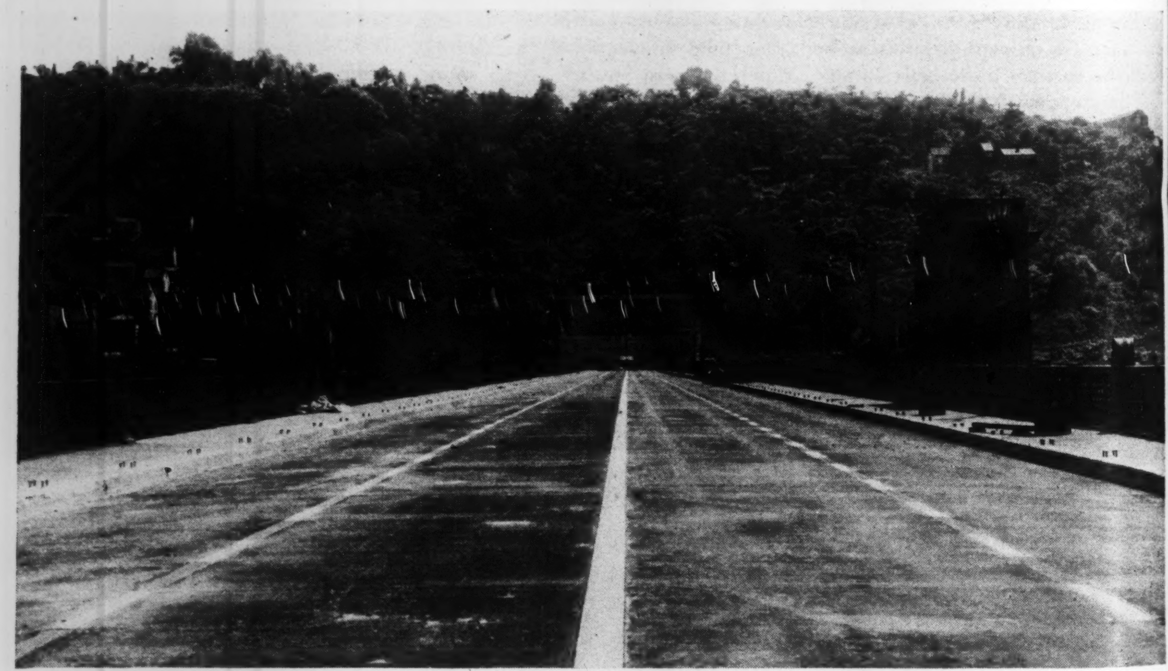
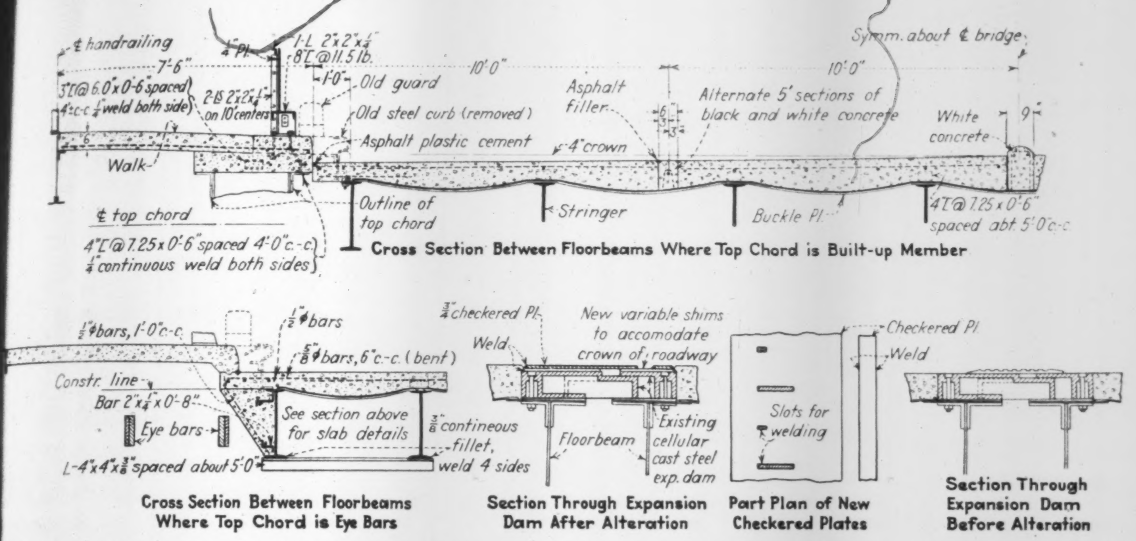


Fig. 1. Wider by 2 ft. than the old pavement, a new roadway provides four 10-ft. lanes on Pittsburgh's Liberty Bridge over the Monongahela River. The 9-in. white concrete medium strip, which rises 3 in. above the roadway pavement, has proven an effective barrier in controlling traffic. Sidewalk guard rails are to be added.


℄ handrailing
7'-6"
3"[@6.0"x0'-6" spaced 4'±c-c ¼" weld both side
¼" Pl.
1-L 2"x2"x¼"
8"[@11.5 lb.
2-Ls 2"x2"x¼" on 10' centers
1'-0"
Old guard
Old steel curb (removed)
Asphalt plastic cement
10'-0"
Asphalt filler
4" crown
Alternate 5' sections of black and white concrete
Symm. about ℄ bridge
10'-0"
White concrete
9"
6
Walk
℄ top chord
4"[@7.25x0'-6" spaced 4'-0" c.-c. ¼" continuous weld both sides
Outline of top chord
Stringer
Buckle Pl.
4"[@7.25x0'-6" spaced abt. 5'0" c.-c.
½"φ bars, 1'-0" c.-c.
½"φ bars
⅝"φ bars, 6" c.-c. (bent)
Constr. line
Bar 2"x¼"x0'-8"
Eye bars
See section above for slab details
⅜" contineous fillet, weld 4 sides
L-4"x4"x⅜" spaced about 5'-0"
¾" checkered Pl.
Weld
New variable shims to accomodate crown of roadway
Floorbeam
Existing cellular cast steel exp. dam
Checkered Pl.
Weld
Slots for welding

Cross Section Between Floorbeams Where Top Chord is Built-up Member

Cross Section Between Floorbeams Where Top Chord is Eye Bars

Section Through Expansion Dam After Alteration

Part Plan of New Checkered Plates

Section Through Expansion Dam Before Alteration

2. To reduce the width of each sidewalk by 1 ft. required new support for those slabs. Over the built-up top chord scheme at the top was used, and when the chord consisted of eye bars, that at the left was followed. To avoid bumps the new expansion dams the old joints were altered as shown at right.

At each of the old expansion dams steel checkered plate projected 1 in. ove the pavement surface. In add g the new concrete slab not only s the resulting bump at each joint iminated, but the new construction creased the crown from 3 to 4 in. d the minimum thickness of the adway slab from 5 to 6 in.

In alteration of the expansion joints, the existing cellular dams were left in place and to these were welded steel filler plates varying in thickness from the outer edge of the roadway to the center (Fig. 2). The variable filler plate thickness accommodated the change in the crown. To each filler plate was welded a ¾-in. thick checkered plate, which was flush with the roadway. Not only did this type of joint prove effective, but the expensive work of removing the old dams was avoided. The new dams are inexpensive.

Pedestrian protection

In constructing the sidewalks an unusual combination guard curb and splash plate was installed. This guard (Fig. 2) has posts on 10-ft. centers

ig. 3. Constructed one lane at a time, the new roadway is supported on the buckle plates of the old structure. The slab as a 4-in. straight slope from the center to the gutter and is 1-in. thicker at the edges. A separately placed strip of lternating black and white concrete is used as a permanent marker for the two 10 ft. lanes of each roadway.

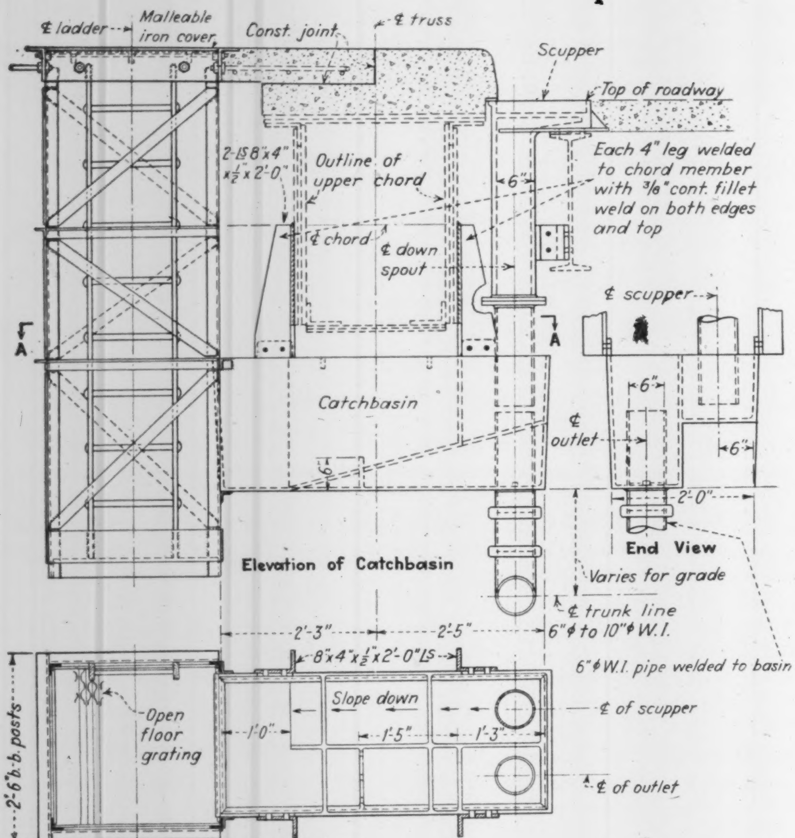


Fig. 4. To prevent clogging of the drainage pipes new catchbasins equipped with baffles to retain debris carried from the deck were installed. Access to the basins is by a metal door in the sidewalk slab.

consisting of two 2x2x¼-in. angles back to back. To this post is bolted a ¼-in. steel plate 22 in. high stiffened at the top by a 2x2x¼-in. angle and at the bottom by an 8-in. channel. This railing, fastened to the curb by four ¾-in. dia. bolts at each post, is considered sufficiently strong to withstand the impact of vehicles. It should be noted that the inner edge of the guard rail is located 7 in. from the curb and that the splash board is back an additional 6 in.

Another major part of the repair work was improvement of the roadway drainage facilities. Over the water, scuppers discharging directly into the river through 6-in. pipe are used, but over land the water had to be collected for disposal into the city's sewers. With the previous drainage over land, the scuppers discharged into a single, wrought iron main of 6 to 10 in. dia., which had a long flat gradient that caused clogging difficulties. With the new system, two longitudinal wrought iron mains of 6, 8 and 10-in. dia., with a minimum of two percent grade are available. Malleable iron scuppers along both edges of the roadway carry the runoff to unique catchbasins, which discharge into the wrought iron mains by means of 6-in. dia. pipe. In order to provide for quick and easy removal of the drainage pipes in case of clogging, special couplings using only two bolts were installed.

Catchbasins eliminate clogging

The catchbasins (Fig. 4) are unusual in that they eliminate clogging of the drainage pipes by material carried from the deck. Water entering the catchbasins, which are constructed of malleable iron, must flow over a baffle wall before reaching the outlet. This wall retains the debris in the basin, which is designed to be easily cleaned by a workman descending from the sidewalk through a metal door.

The repair project cost $272,000, including improvement of the approaches. The work was done by the Department of Works of the County of Allegheny, John F. Laboon, director; Levi Bird Duff, chief engineer; H. J. Dickman, assistant chief engineer in charge of construction; C. K. Harvey, office engineer; and E. G. Messner, resident engineer. Harriso Construction Co., Pittsburgh, held the general contract.

Oil-resistant linings for concrete tanks

More than 2,000 concrete storage tanks of 25,000 to 2,520,000 gal capacity are included in a Navy program for storage of gasoline and oil. According to a Navy release, the problem of porosity of the concrete, which permitted seepage of the stored liquid, has been largely overcome.

The Navy, in cooperation with industry, has developed various types of linings for the inside of the tanks which in effect form a big envelope containing the stored fuel and keep it from seeping through the concrete. For heavy fuel oil it has been found that all that is necessary is to paint the inside of the concrete tanks with sodium silicate (waterglass) four coats giving a satisfactory cover.

Three materials

For diesel oils and gasoline, three different types of lining materials have been developed. One is a vinylite plastic, painted on the interior of the tank. Another is sheet thiokol. cemented to the interior. The third type consists of thiokol in latex form and a layer of cotton fabric.

The latex thiokol is first painted on the inside of the tank. Then the layer of fabric is imbedded in the latex and a coating of thiokol applied over the fabric. Coupled with the use of pre-stressed steel, the concrete tank (*ENR* Jan. 28, 1943, p. 135) is lined so successfully that high-octane gasoline is now being stored in concrete tanks underground.

The steel rods used in pre-stressing the concrete are a decidedly less critical material than shapes and plates. Furthermore, the overall total of steel used in the concrete tanks is less than half the steel used in steel tanks. In some instances, says the Navy, particularly where the tanks are to be located a long distance from steel mills, the concrete tanks can be made at a much smaller cost than comparable steel tanks, and can be built more rapidly.

Steel-Shell Piles for Unusual Foundation

Harry T. Immerman
Chief Designing Engineer
Spencer, White & Prentis, Inc., New York, N. Y.

***ontents in Brief**—Open-end, steel-shell piles which were driven 05 ft. through muck and sand to hardpan and cleaned out by washing nd blowing with air jet, were employed to provide support for a 1,300-on coal unloading dock. Piles for minor structures were driven only art way through a sand stratum over soft clay and additional bearing, here required, was obtained by using more piles rather than extending heir length.*

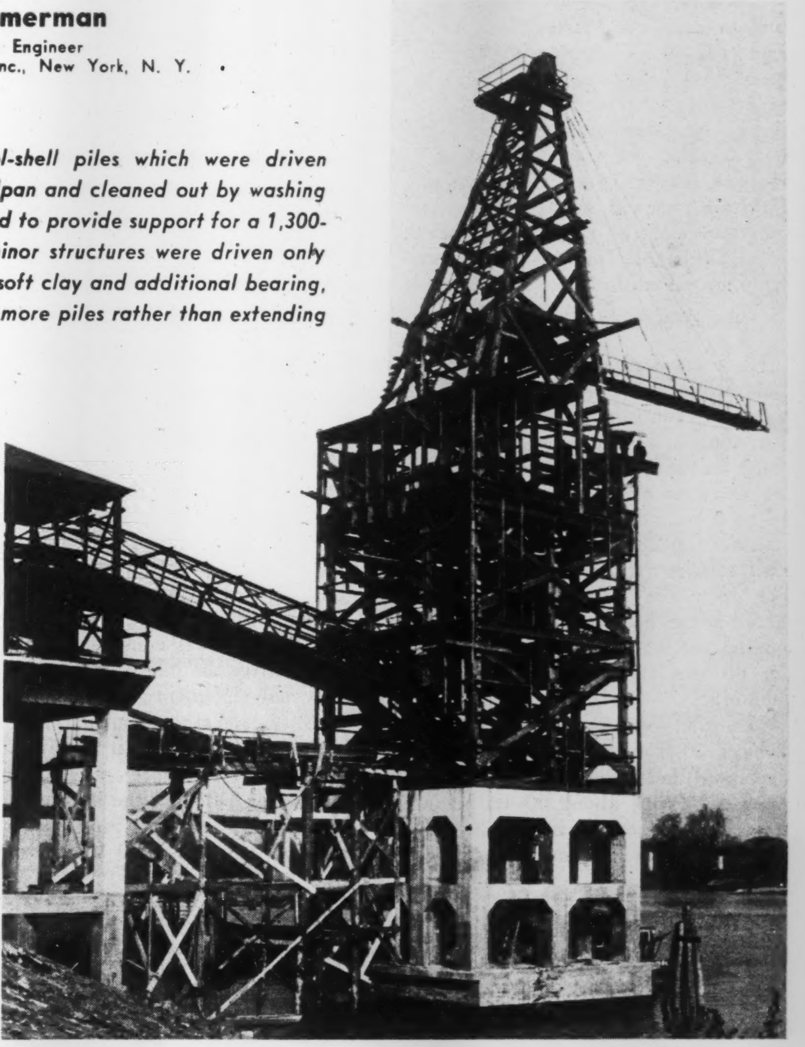


Fig. 1. Timber and concrete coal handling tower supported on concrete-filled, open-end pipe piles driven 105 ft. to hardpan.

PEN-END PILES, driven to hardpan nd cleaned out with water and air ets, were found to be an ecomonical nswer to the problem of supporting 1,300-ton river-side unloading dock. ipe shells, 18-in. dia., were driven o 105 ft. below the water surface, leaned and filled with concrete. For ighter loads on land, closed-end hells were driven through a 20-ft. epth of stored coal to rest on sand bove a soft clay. Thus the steel-hell pile, a rather special tool of the oundation specialist, ecomonically olved two uncommon support problems.

Subsurface conditions were unusual: Below a moderate depth of water there was silt, fine sand, soft lay and similar undependable material of low-bearing capacity to a considerable depth. The strata changed to more stable sand, gravel and finally to hardpan at a little more than 100 ft. below mean low water.

The dock was required quickly to accommodate unloading of coal for operation of a big power plant in the oil-rationed East. The plant is near the water and the most economical means of delivering the coal is in large barges. The river at this point is subject to large and rapid fluctuation in level, and at flood stage often carries a heavy load of ice and debris. Unusually secure foundations to good material were demanded for the high coal handling towers as shown in Fig. 1.

As the demands for power to supply a rapidly growing city have become greater and greater the units of the plant at this location have become steadily larger with increasingly heavy loads to support. Consequently, pile foundations were superseded by caissons to rock.

Pneumatic caissons, open caissons sunk by special methods and finally drilled-in-caissons transmitted the heavy loads to rock about 120 ft. below the surface. The last named process carried the foundations to rock in an open caisson and, as the name implies, about 4 ft. into the ledge. It provided the 1942 plant addition with concrete and steel piers anchored against uplift.

Expensive open caissons to rock did not appear to be necessary for the moderate load of 1,300 tons to be supported over a base 30-ft. square for the coal handling structure or for the lighter loads on land. Here knowledge of the advantages of special types of piles made it possible to select much less costly designs.

Open-end piles to rock

The plan adopted for the high tower called for driving 18 open-end vertical piles 18-in. dia. with steel shells $\frac{1}{2}$-in. thick, cleaning these shells out and filling them with 4,000-lb. concrete. Lateral stability was assured by nine additional piles driven on a batter of 1 to 4. The structure provided for liberal anchorage of both vertical and batter piles into a heavily reinforced concrete slab a few feet above normal river stage.

The pipe was received in 40-ft. random lengths and the sections were connected in the field with an internal drive-sleeve coupling of slightly larger diameter than the inside of the pipe. The piles were driven from leads rigidly attached to a steam-powered crawler crane. The top of the leads was hung from the tip boom-pin and the bottom was held by an adjustable frame connected to the crane cab at the boom-hinge level.

Crane on scow drives piles

The crane was set on a deck scow that also carried the compressor plant, miscellaneous supplies and the pipe required for the work. The boiler on the crane supplied the steam for operation of the driving hammer. All piles were driven open-ended, the material inside not being removed until all the driving was completed. The speed of installation was retarded somewhat by the necessity for moving the barge for each cylinder but no special difficulties were encountered.

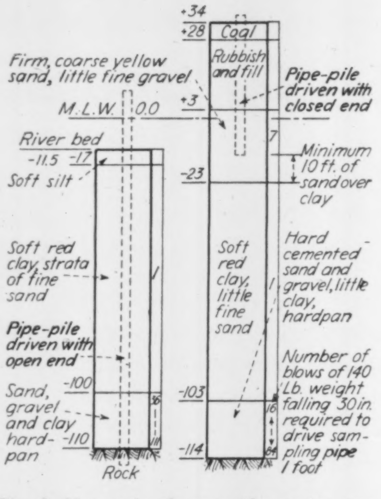

+34
+28
Coal
Rubbish and fill
Firm, coarse yellow sand, little fine gravel
Pipe-pile driven with closed end
+3
M.L.W. 0.0
7
River bed
-11.5
-17
Soft silt
-23
Minimum 10 ft. of sand over clay
Soft red clay, strata of fine sand
Soft red clay, little fine sand
Hard cemented sand and gravel, little clay, hardpan
1
1
Pipe-pile driven with open end
Number of blows of 140 Lb. weight falling 30 in. required to drive sampling pipe 1 foot
-100
-103
Sand, gravel and clay hard-pan
36
16
-110
111
-114
84
Rock

Fig. 2. Heavy loads over the water are supported on pipe-shells driven open-end to rock while lesser loads on shore are supported safely on short piles.

The first section of pipe dropped through 20 ft. of water and 20 ft. of river mud under the first blow of the hammer. From about 60 ft. below the water surface the heavy clay offered increasing resistance to driving, and at a depth of 85 ft. required two blows per inch from a No. 1 Vulcan hammer. The resistance to driving increased until at the hardpan level five blows per inch were required.

Although this hardpan was extremely dense, it was considered important to drive the piles several feet into this material to provide anchorage against lateral movement. The driving records show that it required about 800 blows to secure an average penetration of 3 ft. into the hardpan.

Excavation within the pipe shell, down to a point about 20 ft. above the bottom, was done by washing with a water jet delivering about 200 gpm. at a pressure of 150 psi. At this point the efficiency of jetting diminished greatly, and blowing was resorted to. The same pipe was used for both jetting and blowing, the latter being accomplished by forcing air at a pressure in excess of 100 psi. to the bottom of the pile. Success of the method is illustrated by Fig. 5. The air jet cut loose the material in the bottom of the shell and the entrapped air raised a column of water and solid material out of the pipe. The 27 piles were driven, cleaned out and filled in 50 working days.

Support for the conveyors

From the coal handling tower, conveyors carry the coal to the stockpile and from the stockpile to the plant as required. This equipment is supported on steel bents having a maximum loading of 20 to 30 tons at each leg. In this area a sand stratum about 20 ft. thick at an average depth of 30 ft. below the surface overlies an unstable soft red clay about 80 ft. thick over the hardpan to which the piles were driven for support of the main tower. The loads to be supported were not sufficiently large to warrant foundations carried to hardpan, and investigation indicated that a pile penetrating to a level no lower than ten feet above the bottom of the sand layer would safely sustain 30 tons.

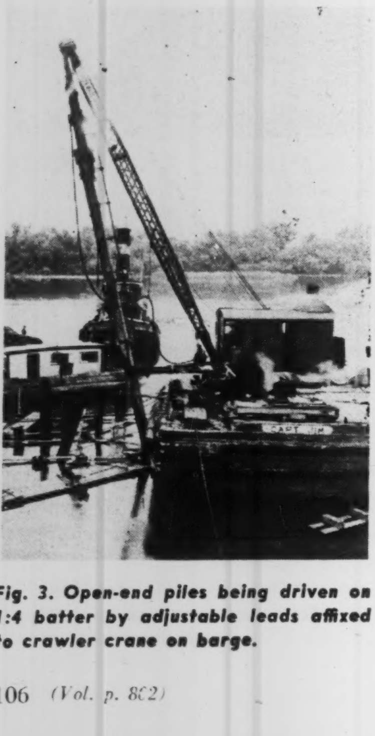


Fig. 3. Open-end piles being driven on 1:4 batter by adjustable leads affixed to crawler crane on barge.

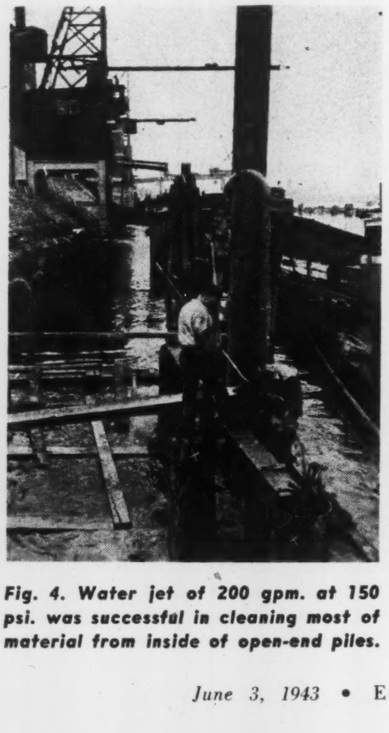


Fig. 4. Water jet of 200 gpm. at 150 psi. was successful in cleaning most of material from inside of open-end piles.

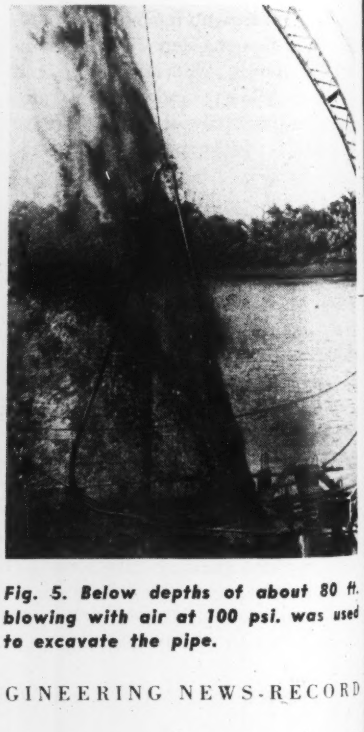


Fig. 5. Below depths of about 80 ft. blowing with air at 100 psi. was used to excavate the pipe.

Piles driven to this predetermined pth were entirely satisfactory, the iving record confirming the engiers' calculations of bearing value the material. For this work $10\frac{3}{4}$-in. D., $\frac{5}{16}$-in. thick pipe piles were iven with cast steel shoes that osed the lower ends of the pipe. here was no difficulty in reaching d penetrating the sand stratum ith the closed-end cylinders, and e of this type pile saved the time d cost necessary for cleaning opend shells.

Several interesting factors were nsidered in the design of the piles rest on sand. Most important, peraps, was a plan to add additional iles of the same length rather than drive deeper if the required bearg was not obtained at plan elevaon. Driving to a greater depth ould leave below the bottom of the ile a less thickness of sand to disibute the loading to the soft clay elow.

Due to application of the driving orce of the hammer to a heavy steel hell of constant section the blow as transmitted with little diminuion of force to the bottom. Since ittle of the force was lost due to riction in the inferior stratum above he sand, the final record of driving ndicated the supporting value of he sand stratum that had to carry he load.

Driving through stored coal

Many of the land piles were driven n an operating plant where it was ecessary to drive through a 20-ft. epth of stored coal that could not e removed. This was accomplished ithout difficulty, and by making a easonable allowance for the small dditional friction developed by the oal, the driving formula was adjusted so that the capacity of the iles, derived from bearing in the and, was not appreciably affected. Use of pipe-piles also permitted driving the piles through the riprap paving of a dike where highwater made mpractical the removal of the stone n advance of driving.

The writer and his company have esigned and installed difficult founations under all sorts of conditions or many years. Tens of thousands f wood piles have been driven, many f them cut-off far below the water urface. Concrete piles both precast nd cast in place have been driven to upport almost every conceivable type of structure. Short lengths of various types of piling have been jacked down beneath foundations to reinforce the footings. From this close association with foundation work has come a belief that concrete-filled steel tube foundations are second only to piers to rock. This coal handling plant foundation is a good example of taking the fullest advantage of the characteristics of this type of foundation.

General planning for the coal handling improvement and construction above the foundation was done by Stone & Webster Engineering Corp., who, since 1920 have served as engineers for the electric company owning the plant. They were represented on this improvement by E. A. Dockstader, chief structural engineer, and T. C. Williams, construction superintendent.

The foundation work was done by the writer's firm, Spencer, White & Prentis, Inc., of New York, for whom George F. Flay, Jr. and Daniel J. Barrows were engineers in charge in the field, and Michael Kenny, superintendent of construction. The utility company was represented by T. H. Soren.

Concrete Blocks Used to Line Shield-Driven Tunnel in London

Precast tunnel lining segments of reinforced-concrete which are similar in shape to the conventional cast-iron segments, and are bolted together in the same way, have been tried experimentally in shield-tunnel construction on an underground railway extension by the London Passenger Transport Board, England, as described in a recent paper before the British Institution of Civil Engineers. According to the author, G. L. Grove, such segments have never before been used in shield tunneling.

The lining rings are 20 in. wide on the face, and each ring consists of six segments and a key block, all with a face thickness of 2 in. Both the face and the flanges are much thicker than that in cast-iron, and each segment has four transverse ribs connecting the circumferential flanges. In each flange are four $\frac{3}{8}$-in. rods and $\frac{3}{16}$-in. stirrups. In a complete ring, the reinforcement weighs 245 lb. and is 2.1 percent of the volume of concrete. The segments are connected by bolts through the longitudinal flanges, and the rings by bolts through the circumferential flanges.

To test the rigidity of the lining, a short tunnel was driven, having 30 in. overburden, and was lined with three rings of the concrete segments and three rings of cast-iron segments. Under a surface loading of $1\frac{3}{4}$ tons per sq. ft., both types of lining flattened about an inch, but only one slight crack appeared in the concrete, while two of the iron rings were cracked at the crown. Instead of specifying a definite concrete mix, test specimens were required to show a compression strength of 4,000 and 6,000 lb. at 7 and 28 days, respectively. It is stated, however, that in construction higher strengths were averaged. The segments were made in steel forms on vibrating tables.

Thrust of 450 tons

Strength in resisting the jacking thrust on the shield was tested in actual tunnel construction, where the thrust was approximately 450 tons. The thrust was taken by a special steel ring of channel section, but having one rib shorter than the other and faced with hard rubber. This shorter rib was placed against the concrete ring, in order to concentrate the pressure near the thick face of the ring instead of distributing it over the full depth of the ring.

A cost saving of nearly 20 percent as compared with cast-iron lining, was reported, on the basis of construction of two separate miles of twin tunnels. While the standard outside diameter of the underground railway tunnels is 12 ft., that of the concrete lined tunnel was made 12 ft. 3 in., due to the greater thickness of the face of the lining and the necessity of maintaining the standard diameter in order to accommodate the signal apparatus and other internal equipment.

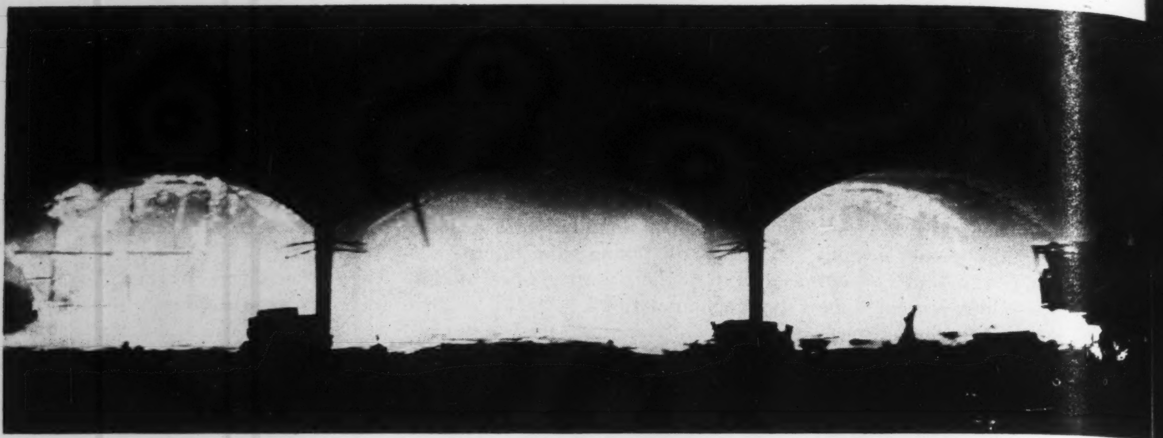


Fig. 1. Fierce form fire causes little damage to thin-section concrete roof barrels.

Thin Concrete Roof Withstands Fire Test

J. E. Kalinka
Vice President, Roberts & Schaefer Co.
Chicago, Ill.

***Contents in Brief**—The ability of thin-shell concrete barrel roofs to withstand fire was recently demonstrated at a military establishment when partly-cured concrete shells were subjected to extreme heat and sudden load changes as the supporting formwork burned away. Examination showed damage confined to light spalling and minor cracking. Load tests proved structural soundness of the concrete.*

FORMWORK FIRES in concrete buildings during construction are not uncommon, but it is seldom that any serious damage or impairment of strength of the structure has resulted. This lack of damage was again demonstrated recently when a thin-shell roof structure under construction in the Southeast was subjected to a fire that destroyed 110,000 b. ft. of forms and shoring. The 3½ in. thick concrete shells withstood the severe and unusual exposure without loss of utility, and required only simple repairs to remedy the surface damage.

The section of the building in which the fire occurred, a one-story area 240x400 ft., is covered by a Z-D barrel-shell roof supported by concrete columns 50 ft. apart longitudinally and 60 ft. transversely. The barrels have a normal thickness of 3½ in. increasing to 4½ in. near the 10x30-in. longitudinal edge members. Exterior transverse frames located at each row of columns stiffen the barrels. In the center of each bay is a 7x9 ft. 4 in. ventilator opening surrounded by an 8-in. curb. Columns are 16½ ft. high to the spring line of the barrels.

Concrete not fully hardened

The final placement of concrete in the roof was made January 19, over the area shown cross-hatched in Fig. 2. The air temperature at the time of placing concrete was 65 deg. but it began to fall abruptly to 20 deg. within 24 hours. Inadequate provision had been made for this unexpected drop in temperature with the result that the concrete froze. Within two days the temperature had risen to 32 deg. and, thereafter, until the fire occurred on Feb. 15, the daily temperature fluctuated between 32 and 60 deg. with an average of 45 deg.

The day following the concrete pour, kraft paper was placed over the west half of the area and all the concrete was covered with tarpaulins. Four salamanders were set under each barrel. By this time, however, the concrete was thoroughly chilled and considerable moisture had evaporated, so it is questionable if very much hydration of the cement took place before the heat was discontinued at noon on the second day. From then until Feb. 1 no heat was provided as the average air temperature was 42 deg. By Feb. 1 it was evident that the concrete was not gaining strength as it should, so the east half of the roof section was covered with kraft paper, additional tarpaulins were provided and steam heat was introduced above the roof while salamanders were used below. By these means the temperature above the slab was kept close to 68 deg., while below the slab it was about 60 deg.

From conditions prevailing between the placing of concrete and the fire, it should be apparent that the concrete could have gained only a part of its normally anticipated strength. This is shown by the record of specimens taken from the roof slab and tested after periods of 13 to 25 days. The concrete, made with ¾-in. gravel aggregate, was designed for 3,000 psi. at 28 days, but four specimens tested at 25 days showed only 2,892, 2,165, 1,189 and 2,287 psi., respectively. The relatively low trength of concrete at the time of the re makes the shell performance all e more remarkable and provides nvincing evidence of the ability of hin-shell concrete structures to tand unusual abuse.

Fire destroys formwork

At 11 p.m. on the 27th day after e roof pour, fire broke out in the imber centering. By 1 a.m. the blaze as extinguished, but not before the orms and centering had been completely destroyed. The roof was then elf-supporting. The fire was intense for about 1½ hr., and complete loss of at least the west portion of the building was anticipated. The exact cause of the fire could not be determined, but apparently the lumber had become very dry and one of the salamanders may have been unusually hot, as the outside temperature had again dropped to 20 deg.

The insulating value of the plywood forms was clearly demonstrated by an examination of the structure after the fire. For 50 to 75 ft. in either direction from the formed area, minor cracking and spalling occurred, while practically no visible damage occurred in the area where forms were still in place.

Where spalling occurred it was quite shallow. The roof steel, covered with 1 in. of concrete, was exposed in only a very few places. Examination of the top of the barrels showed a rather typical pattern of fine cracks, generally less than $\frac{1}{32}$-in. wide, near the crown of each barrel. In the crown of the frames, fine cracks extend from the top face downwards, disappearing about 10 in. above the roof shell. The pattern of cracking indicated that the shell and frames tried to bulge upward from the expansion caused by the rise in temperature. There was practically no evidence of cracking on the inside of the roof nor in the areas of the barrels reinforced with diagonal steel.

All damaged sections of the concrete roof were repaired by first sandblasting away dirt and loose material, or otherwise removing all unsound concrete. Cracks which could not be expected to heal autogenously by applying water to the surfaces to further cure the concrete and restore moisture to the partially dehydrated areas, were widened with hand tools and then grouted. The underside of the roof was covered with ½ in. to 1 in. of shotcrete to fill surface spalls and restore the appearance of the structure.

Loading test

About a month after the fire and before any repairs had been made on the structure, a full-size loading test was performed on one of the damaged roof panels by placing a pattern of brick on edge, resulting in a uniform load of approximatley 40 lb. per sq. ft. Deflection measurements were made at various points with Ames dials. The maximum deflection occurred at the quarter-point of the barrel and was approximately 1/6,000 of the span, equal to 0.1 in. The theoretical deflection of the edge members under live load was calculated to be 0.027 in., whereas the actual deflection amounted to 0.025 in., almost in complete agreement. After removing the load on the second day, a very satisfactory recovery of the shell was observed, proving that the structural soundness of the building had not been impaired by the fire.

Pull-out tests made

Pull-out tests were also made to determine the carrying value of malleable iron inserts embedded in the area of the 3½-in. concrete shell affected by the fire. These inserts contain a ¾-in. dia. bolt and are designed to carry a 1,500-lb. concentrated load. A test load of 4,200 lb. was hung from each of six different inserts, causing no cracking of concrete or pulling-out of inserts. The deflection of the shell slab measured at inserts in the crown of the barrel was $\frac{3}{32}$-in., in line with the theoretical deflection.

Estimated fire damage was $12,000, a small percentage of the $500,000 spent on the structure up to the time the fire occurred.

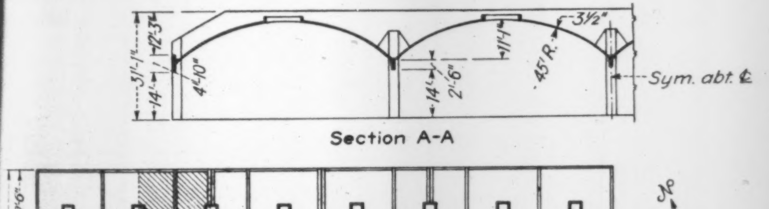


Fig. 2. A 75-ft. wide section of plywood forms and timber centering for the roof arches was completely burned. Minor cracking and spalling of concrete occurred for about 50 ft. each side of the formed area, while practically no damage to the concrete was visible in the formed area due to the insulating properties of the plywood used in the forms.

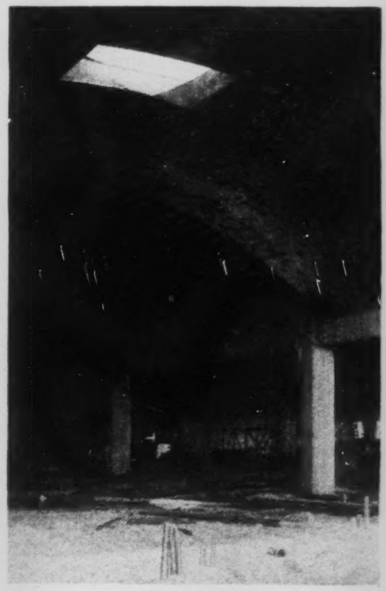


Fig. 3. Fire damage to the concrete roof was confined to minor cracks and slight spalling. Damaged areas were sandblasted clean and coated with a thin layer of shotcrete.

Fighting Water in a Bridge Foundation

Contents in Brief—*Water flowing into the sheet pile cofferdams through honeycombed limestone bedrock delayed completion of piers for the Bowling Green Bridge in Kentucky nearly a year. After several schemes proved unsuccessful cement grouting was found effective. The channels in the bedrock outside the cofferdams were located by probing with a long jet pipe and the same tool was used to force into the fissures at high pressure a thick grout, which combined with the sand and gravel to seal the openings.*

CEMENT GROUT HAS SOLVED one of the most difficult bridge foundation jobs ever to be carried out for the Kentucky State Highway Department. Construction of the river piers for a new highway crossing over the Barren River at Bowling Green was complicated and seriously delayed by the heavy flow of water through the channels and mud seams in the honeycombed limestone bedrock so common to the cave region of southern Kentucky. Since many construction schemes were tried before the use of cement grout proved successful, the procedures used are of special interest.

The new crossing, which is to provide a 24-ft. roadway and two 5-ft. sidewalks, consists of a four-span, continuous plate-girder structure with each span 110 ft. long. The foundations consist of an abutment on outcropping rock at the Bowling Green end, three piers about 85 ft. high in the deep river gorge, and an abutment on long precast piling with a superimposed, counterforted wall support at the east end. The bedrock across the gorge is at varying elevations with several feet of the top extensively honeycombed and filled with mud pockets. Solid rock is at a fairly uniform level 35 ft. below normal low water and 10 to 28 ft. below the top of the honeycombed material. Difficulty in construction occurred at only Piers 1 and 2, normal construction procedure proving satisfactory for the other foundations.

At Piers 1 and 2 a considerable depth of the overburden above the limestone was coarse gravel and sand containing numerous large boulders; in the top stone seams as much as 9 ft. deep occurred. The material in places was so soft that cores cou not be recovered and at many poin the seams and channels were fille with a mixed mud, clay, gravel an sand, as illustrated by the boring dat shown in Fig. 1. Sufficient stabilit for piers 85 ft. high, which were ne essary to keep the bridge floor abov extreme high water, make it manda tory that the foundations rest on goo rock. Thus, it was necessary tha within the cofferdams all the cav ernous limestone, in many cases i layers 8 to 10 ft. thick, be excavated

The construction plan was to us timber-braced, sheet pile cofferdam slightly larger than the required pie footing size. This procedure require that the rock be excavated so that th pile sheets could be extended to soli rock at the pier footing level.

Construction of the two river pier was similar except that a slightly larger cofferdam was required fo Pier 2 to accommodate the larger siz footing—22 x 59 ft. as compared t the 19 x 67-ft. member for Pier 1 The larger cofferdam had an outsid dimension of 26 ft. 6 in. by 62 ft 4 in. and it is braced with nine sets of wales—seven of 14 x 14-in. tim bers and two of 12 x 12-in. members

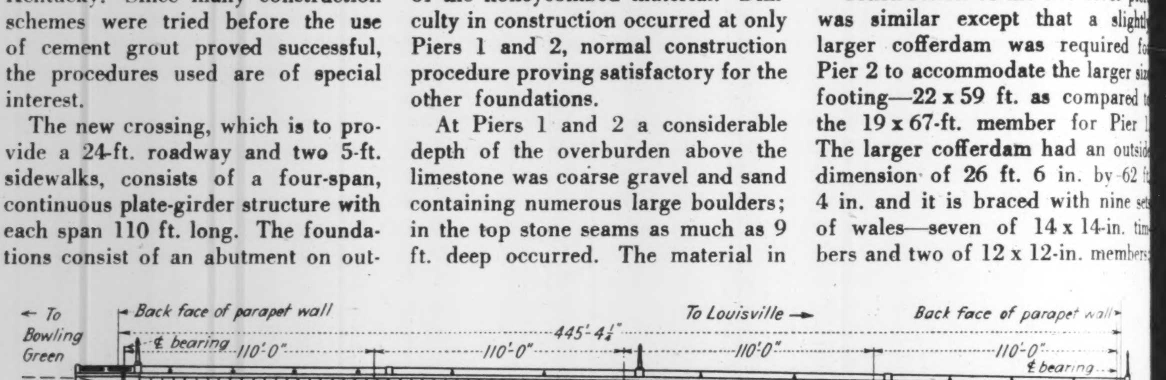
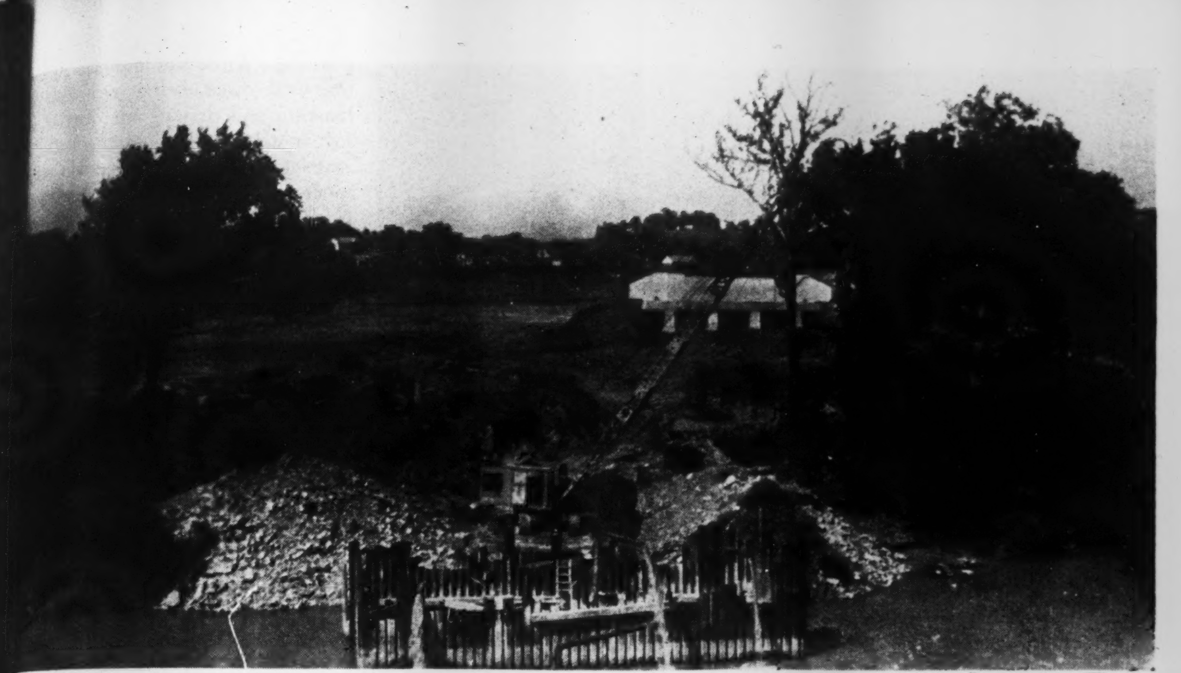

← To Bowling Green
Back face of parapet wall
445'-4¼"
To Louisville →
Back face of parapet wall
℄ bearing
110'-0"
110'-0"
110'-0"
110'-0"
℄ bearing
Exp.
Abutment 1
El. 465.6
Exp.
1913 H.W. El. 461.5
El. 464.3
Fix.
El. 462.3
Exp.
Exp
82'-7⅛"
79'-10⅝"
Dry rip rap
14" precast concrete piling
Elevation
El. 389.0
Solid rock
2'
El. 381.0
El. 389.0
El. 381.0
El. 389.0
El. 381.0
El. 381.0
Pier 1
Pier 2
Pier 3
Solid rock
Solid rock
Abutment 2
Boring Legend
▨ Gravel and coarse sand
▨ Sand and blue muck
■ Solid white limestone
▩ Sand, gravel, and yellow muck
40'-6⅞"
50'-9⅛"
28'-11"
El. 411.5
396.4
395.7
392.0
382.0
El. 411.2
393.9
381.7
371.7
Boring 13
Boring 14
16'-0"
54'-0"
57'-0"
19'-0"
19'-0"
56'-0"
59'-0"
22'-0"
388.1
381.8
El. 403.1
396.8
392.3
386.2
371.84
Boring 15
El. 403.4
387.3
383.6
382.1
372.1
Boring 16
Flow
20'-0"
56'-0"
59'-0"
23'-0"
21'-0"
15'-0"
Slope 2 to 1
48'-0"
Plan of Substructure

Fig. 1. Stability for 83-ft. high piers could be assured only by extensive excavation of limestone bedrock, which was extensively honeycombed as shown by boring records.



ig. 2. Even after extensive grouting work and completion of seal course, inflow into cofferdam for Pier 2 continued to be extensive, due to damage to steel sheet piling during driving. This picture was taken from west bank looking east with completed abutment in background.

wo 14 x 14-in. cross struts for each et; and 8 x 14-in. kneebraces at all corners and at the struts. Because construction of the cofferdam and pier footing was the same at both piers, only the methods followed at Pier 1 will be described.

Construction of cofferdam

The cofferdam for the foundation of Pier 1 was built with land equipment, a trestle being constructed out to the cofferdam location. Interlocking steel sheetpiling of 16-in. width, -in. web thickness, 40 to 50-ft. in length and weighing 36 lb. per sq.ft. was used. The sheets were set around the assembled frames and driven down to rock with a double acting, medium-weight steam hammer. The seven rings of wales were tied together, and as the overburden was removed the frames for the first several feet settled under their own weight. However, for the last 10 ft. of the excavation, the bracing had to be driven down with the pile hammer.

It was not possible to drive the piling into the limestone, even where the rock was in layers only a few inches thick. Thus, driving of the piling and excavation had to be carried out simultaneously. The procedure followed was to drive the piling to the greatest depth possible, remove the enclosed overburden, excavate under the wall of sheetpiling and drive it down progressively. Sometimes when a layer of rock was broken through, the piling could be driven several feet, but successful extension of the piling required that in all cases the inflows be reduced sufficiently to be handled by pumps.

To accomplish this, rock was removed from a depth of about 3 ft. beneath a section of only 12 ft. of wall at one time. To do this, sloping 2-in. dia. holes were drilled on 2-ft. centers to such a depth that the bottom of the holes was about $2\frac{1}{2}$ ft. directly below the bottom of the piling. In each hole one-half stick of 60 percent dynamite was placed and the charges were set off simultaneously. This method resulted in little damage to the piling and immediately afterward the sheets for that portion of the wall were driven as deep as

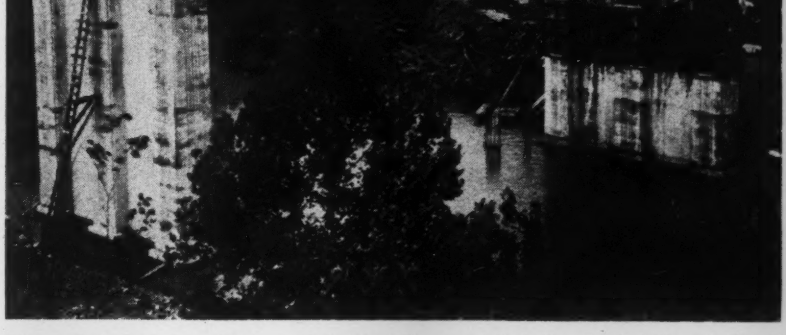


Fig. 3. Later picture from west bank with completed Pier 1 at left and Pier 2 under construction at right.

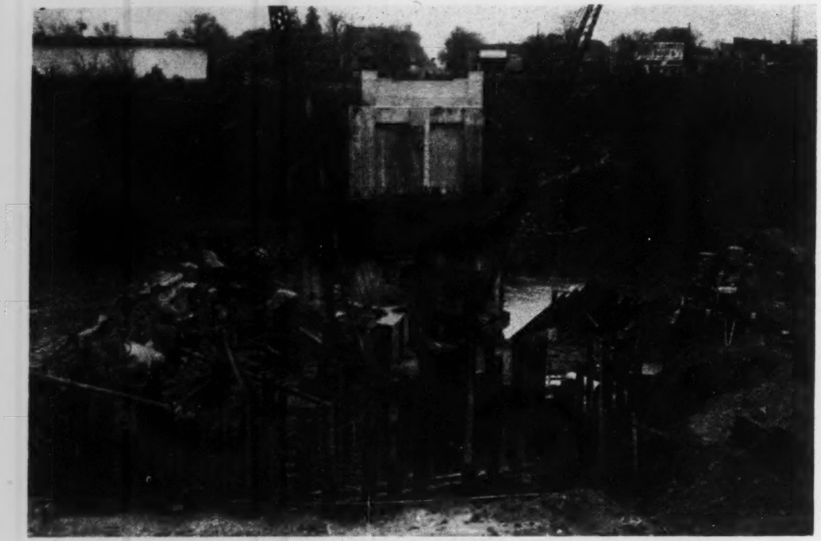


Fig. 4. Looking west from east abutment at Pier 3 under construction inside cofferdam in foreground, and Piers 2 and 1 and west abutment in background. Two pumps with discharge pipes shown at left, were able to keep cofferdam sufficiently dry that Pier 3 could be built without seal course.

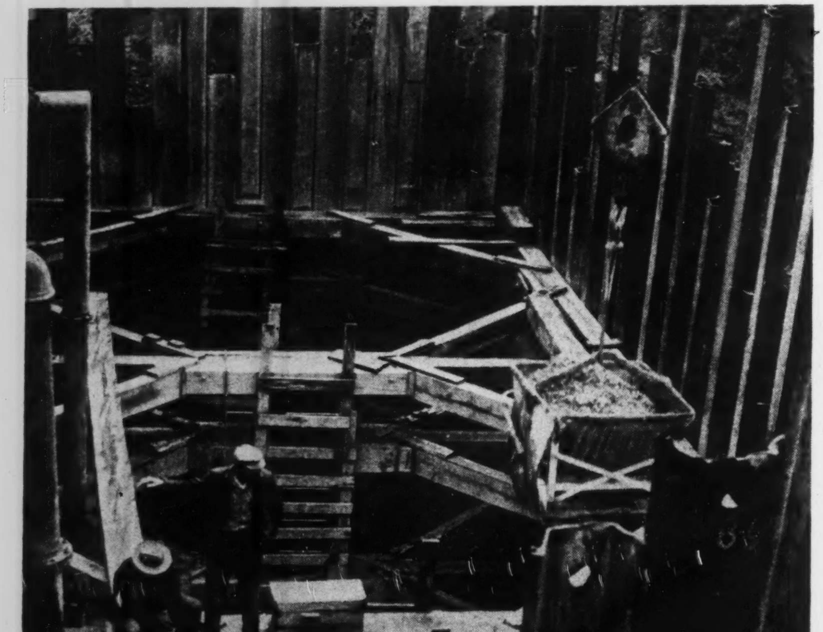


Fig. 5. Cofferdam for Pier 3, was heavily braced with timber. Note two 6-in. dia. discharge pipes at left for unwatering pumps. Same timbering, sheet-piling and pumps had been previously used for Pier 1.

possible. While the loosened rock on that side was being removed, the blasting and driving was carried out for another portion of the wall. By restricting work to a very short distance, it was possible to control the increased flow into the cofferdam.

Removal of rock within cofferdams

In contrast, removal of the material within the inclosure produced flows so great that operations were often interrupted. For this part of the work 2-in. dia. holes 5 to 6 ft. deep were drilled on about 5-ft. centers along two longitudinal lines roughly 8 ft. apart. In each hole two or three sticks of 60 percent dynamite were placed and all the charges detonated simultaneously. This blasting not only loosened considerable rock, but frequently resulted in a sudden heavy insurge of water into the cofferdam. Very often the flows were so great that operations within the enclosure were flooded almost immediately. Sometimes the water rose so fast that the gasoline-driven pumps had to be removed. By keeping the pumps in operation while being raised, it was possible to check the rise of water in the cofferdam, thus allowing a little more time for the other pumps and tools to be removed.

In attempting to halt the flow of water several methods were tried before a successful procedure was developed. Sand bags were placed first outside the cofferdam. They were stacked on the river bed two or three bags thick for several feet in all directions from the enclosure. They proved of little value as leakage continued at a high rate; in several cases the bags appeared inside the cofferdam, having been carried into the inclosure by the rush of water through channels in the stone below the steel piling.

Willow mats not effective

Next willow mats covered with sand bags were tried and these proved little better, although extensive pumping from within the cofferdam continued 24 hr. a day. The third unsuccessful method was laying down a continuous willow mat all around the cofferdam, adding a layer of straw; next another continuous willow mat and then sand bags. Although this helped for a time, the mats often gave way and a sudden inflow filled the enclosure. One flow into the cofferdam was so great that a 20 x 30-ft.

at placed 30 ft. away was carried to the cofferdam.

Since these methods had proved inlequate to stop the flow of water d very little progress had been posble, the contractor finally decided use cement grout.

Job-made jet employed

This grouting work was carried out ith a job-made grouting machine repared by welding a top and botm to a steel pipe 8 ft. long and of in. dia. The top was equipped with ¾-in. valve to permit inflow of air d a second valve for adding cement rout. To the bottom of the cylinder as welded 40 ft. of 2-in. dia. pipe at ended in a perforated point. Air as available from a 210-cfm., dieseliven compressor.

The perforated point of the jet was sed as a probe to locate the channels d seams in the rock. Experience howed that it was best to work about 0 ft. from the cofferdam. Thus, the t was supported by the 70-ft. boom f the crawler crane used to handle e pile driver, and the jet was operted by a small crew stationed on a ood barge that could be shifted bout as the job dictated. By using n air pressure of 110 psi., it was posible to force the 2-in. dia. pipe to ts full depth in the mud and water.

To permit maximum benefit from e grouting operation, it was seldom dded unless the water in the cofferdam was at the same height as the iver stage or when there would be ittle flow in the channels and seams. High-early-strength cement for making the grout was delivered to the arge by crane and was mixed with ater by hand. To add the grout, he air supply to the 6-in. cylinder was shut off and the cylinder filled ith a mix as thick as could be handled. Next the air pressure was suddenly applied and this forced the mix down through the 2-in. pipe and into he channel or seam, where it combined with gravel and sand to form a poor grade of concrete.

Grouting is extensive

The grouting work often continued for an 8 hr. period. A crew of 60 to 70 men was employed for all operations, and work continued 24 hr. per day seven days a week. Although the grouting required but a small crew, most of the men were generally kept on the job. How long any one part of the work would take or how soon the entire crew would be needed was difficult to determine. By using the jet as a probe the size of a channel could be found, and as soon as all the grout had been added that was considered necessary to close each channel, the crew on the barge moved to a new location and grouted all the channels located at that point. After this work had advanced completely around the foundation site, which occasionally required 500 bags of cement, unwatering of the cofferdam was started. Sometimes operations could continue within cofferdam No. 2, although work was shut down at No. 1 while grouting was in progress.

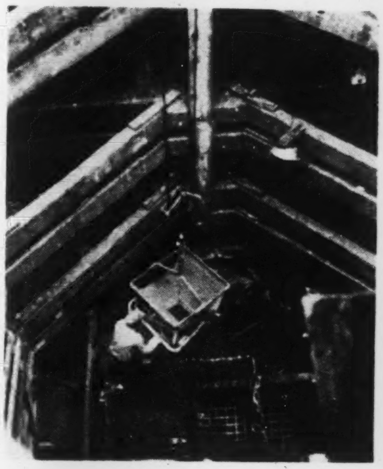


Fig. 6. Concrete for Pier 3 was placed with bottom-dump bucket. Cofferdam for this foundation was sufficiently dry that no seal was required.

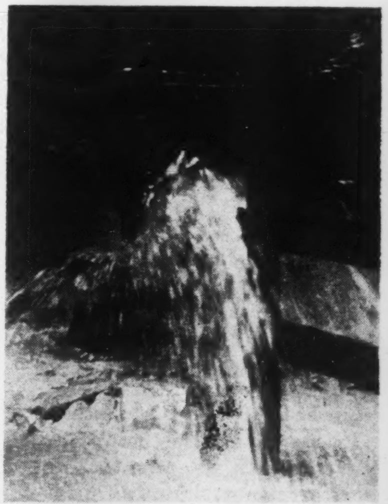


Fig. 7. Start of bad "blow in" at Pier 1. River stage was 40 ft. above bedrock shown in foreground and flow was so heavy that six unwatering pumps had to be removed almost at once. Thirty minutes later cofferdam was almost full. By heavy grouting about 30 ft. outside of enclosure, flow was halted and 30 hours later cofferdam had been unwatered and crew was back at work.

Unwatering of each enclosure was by six gasoline-driven, centrifugal pumps, three 8-in. and three 6-in. units. When excavation was under way all six pumps were operated continuously. It was difficult to keep the water sufficiently low, even after the grouting work was completed. Often a blow up would occur causing the enclosure to be flooded. When this happened it was necessary to repeat the grouting operations, which occured so often that 9,000 bags of cement were required for the grouting work around the two cofferdams.

Seal course placed underwater

Once all the rock necessary had been removed and the crews were ready to construct the seal slab, the cofferdam was allowed to fill with water. Next, with no pumping in progress, concrete for a 4-ft. thick seal was placed under water with a special 1-yd. bucket handled by the crane previously mentioned.

The bucket was made on the job. It consisted of a 10-ft. high section of a 2-ft. dia. steel pipe with a separate cone-shaped bottom with a diameter slightly over 2 ft. and with the tip of the cone extending up into the cylinder. The bucket was handled by two lines from the crane, one joined to the bucket and one passing through the container to the bottom. When filled it was handled by the line to the bottom, but once inside the cofferdam and lowered to the level of the seal coat, the bucket could be dumped by tightening the line to the 2-ft. pipe sufficiently to provide an opening 6 to 12 in. high between the cylinder and the bottom.

Although it was possible with this underwater method to distribute the concrete where needed with little trouble, 10 percent additional cement was added to the mix, which was a 1:2:4 mix made with high-early-strength cement. Construction of the 4-ft. seal coat required about 14 hr. continuous work and unwatering the cofferdam was not started until 72 hours after the last concrete had been placed. The completed seal was about 10 ft. below the lowest wale of the timber bracing. The seals for both the west and middle piers were constructed in May, 1942, or ten months after construction of the cofferdams was started. Concrete was mixed in a ½-yd. portable machine set up on the river bank at a location where the crane could swing the bucket from point of load to discharge.

After the seal had been completed, trouble from water did not end, as much of the piling had been damaged while being driven through an overburden with many large boulders. In fact, some of the sheets were damaged so severely that for one side of Cofferdam No. 2 five sets of piling had to be driven. Damage due to the crevices in the bedrock was also severe, and for this cofferdam a total of 85 pieces of steel piling, or about ½ of that needed had to be replaced. However, by constant operation of the unwatering pumps, it was possible to continue construction of the pier without serious delays.

For the concreting work above the seal slab a ½-yd., bottom-dump bucket of the type shown by an accompanying picture and handled by the crawler crane was used. The concrete was placed in the dry. After Piers 1 and 2, each requiring 980 cu.yd. of concrete, had been completed, all of the timber wales and piling for the cofferdam were salvaged. For this work the crane was able to remove the steel sheeting one pile at a time.

No trouble with third pier

Construction of the third pier, which was on land, did not encounter serious trouble from water. This cofferdam was built from the same materials used for Pier 1 but here a total of 45 ft. of overburden and 15 ft. of rock had to be excavated.

The bottom wales of the cofferdam were 36 ft. below low water, but no large flows were encountered and the pumps were able to keep the cofferdam sufficiently dry so that no seal course was required. It is probable that the extensive grouting at the other piers followed the seams an caverns in the rock accounting fo the small amount of water encountered in the Pier 3 cofferdam.

Those in charge

The bridge is being built by th Kentucky State Highway Department, T. H. Cutler, chief engineer G. L. Logan, director of construction H. R. Creal, bridge engineer; G. H Hailey, district engineer at Henderson, and Charley Davis, resident engineer, The Foster & Creighton Co Nashville, Tenn., with J. H. Kratoska superintendent, is the general contractor for the foundations. The contract price was $209,600 for the tw abutments and three piers. The uni price for the concrete in the completed foundation was about $30 pe cu.yd. The bridge was originally scheduled to be opened last summer but now is not to be completed unti the summer of 1943, due to delay constructing the foundations.

Glued Laminated Beams Carry Test Load of 502,410 Lb.

Five hundred glued laminated beams 30 and 40 ft. long and with sections of 19x41 in. and 19x43 in. were recently fabricated in Seattle for a naval storehouse. The beams were designed to carry a live load of 6,000 lb. per lin.ft. Preliminary to this project was a test of two of the beams 30 ft. long under a total load of 502,410 lb. For this test the two beams were spaced 15 ft. on centers and on them was built up a box into which sand was placed until the required load had been accumulated. Under this 38 percent overload, the 30-ft. laminated beams showed deflections at the center of about ⅞ in. Under the designed load the deflection was only ½ in. After the 4 days during which the load was allowed to remain, deflections increased slightly.

In assembling the beams, casein glue was used, and pressure was applied by clamps drawn up by bolts. Alternate laminations were made up of two 10-in. planks, then an 8-in and a 12-in. plank of random lengths. All laminations were 2 in thick, surfaced four sides. The three top laminations and the five bottom laminations were of select merchantable Douglas fir with scarfed end joints. The intermediate laminations were of No. 1 Douglas fir butted.

The beams were fabricated by the Attwell Construction Co., Seattle. The storehouse was designed and built by the Austin Co.

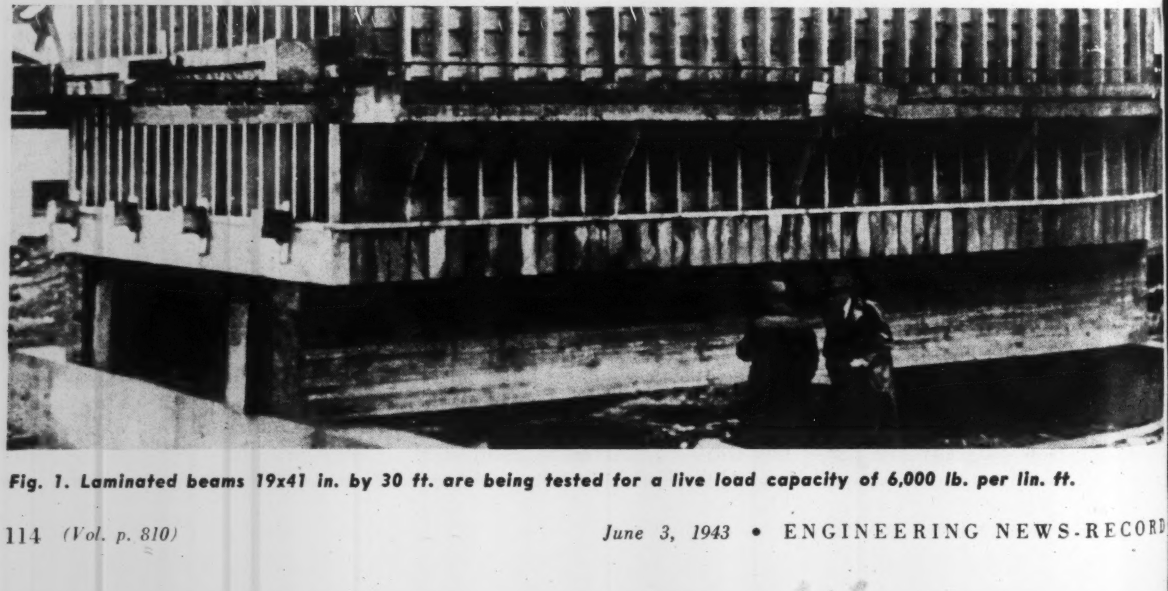


Fig. 1. Laminated beams 19x41 in. by 30 ft. are being tested for a live load capacity of 6,000 lb. per lin. ft.

Setting Utilities Poles with High Explosives

SMALL QUANTITIES of explosives have been used recently to simultaneously excavate a hole for a pole and drop the pole to the prescribed depth in the erection of a utilities line. About 700 poles were erected by this method in soil varying from moist sand to extremely wet swamp muck underlying a sand subsoil. The average ground condition was sand with a water level about 2 ft. under the surface, below which the sand flowed freely into the holes.

The load in each hole varied according to the depth of the hole and the character of the soil. From one to three $1\frac{1}{4}$-in. by 8-in. cartridges of 50 percent nitroglycerin dynamite, averaging about one and a half cartridges per hole were used. Very wet holes required only about half as much dynamite as those located in well-packed, wet sand.

In most of the holes, a loosening charge of one-third to one-half cartridge was used preliminary to placement of the setting charge. Where very hard subsoil was encountered, two or three preliminary half-cartridge shots were made; an average setting charge was then usually adequate to drop the pole.

The poles were set an average of 6 ft. below the surface, being dropped with the final dynamite charge an average of about 3.5 ft. Class 1 poles up to 45 ft. in length were set as deep as 10 ft. below the surface.

Step-by-step procedure

The operation of loading and firing the holes and setting the poles is described in the chronological order of actual operation:

The hole is first excavated by hand to a depth of about 12 in. A loosening charge, consisting of one-third to one-half of a cartridge of dynamite is placed 3 ft. below the ground surface in a preliminary hole and fired without backfilling. This preliminary charge partially dried out the soil and loosened a firm layer of sand about 4-ft. deep sufficiently to permit easy loading of the setting charge.

The preliminary hole is cleared of muck and loose soil and a special loading tool used to put the dynamite at the position desired for the final charge. The loading tool used (Fig. 1) consists of a piece of $1\frac{1}{2}$-in. pipe 8 ft. long, with a T-handle.

A solid iron bar a few feet longer than the loading tool is churned up and down inside the tool to carry the pipe down to the level to which the butt of the pole is expected to drop.

The charge of dynamite is primed with a No. 6 electric blasting cap with the lead wires securely looped around the cartridge. The punching rod used inside the loading tool is withdrawn and the explosive charge is inserted without delay. The charge is pushed down with a stick about 12 ft. long while the lead wires to the cap are held taut (Fig. 2).

The $1\frac{1}{2}$ in. loading pipe is withdrawn, the charge being held firmly in place by the loading stick, which is allowed, with the lead wire, to slip through the pipe as the pipe is withdrawn. The lead wires are ready to be connected to the firing circuit. After the pipe is removed, the loading stick can be withdrawn without danger of the charge floating.

The pole to be set is brought to the location with a truck-mounted pipe derrick and set into the hole. The pole is straightened and aligned in position, being held by pike poles while the hole is backfilled to about ground level. Besides preventing excessive scattering of muck and water, the backfill appears to aid the explosives in forming a more open pocket, thus insuring that the pole will drop the desired distance.

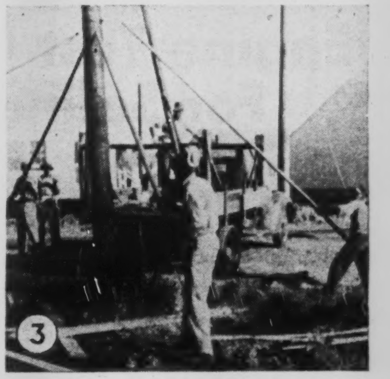
As the charge is detonated, the pole jumps slightly, releasing the pike poles (Fig. 3) and then dropping into place. The pole usually drops to within a very few inches of the desired depth (indicated by the line on the pole in Fig. 4.) Some straightening, then backfilling and tamping complete the placing of the pole.

The pole setting described formed part of an airport construction project carried out by the Newton-Glenn-Knost-Jones organization, Biloxi, Miss., under the supervision of the Corps of Engineers, U. S. Army.

Abstracted from an article by J. L. Mattox in THE EXPLOSIVE ENGINEER.

①

②


③

④

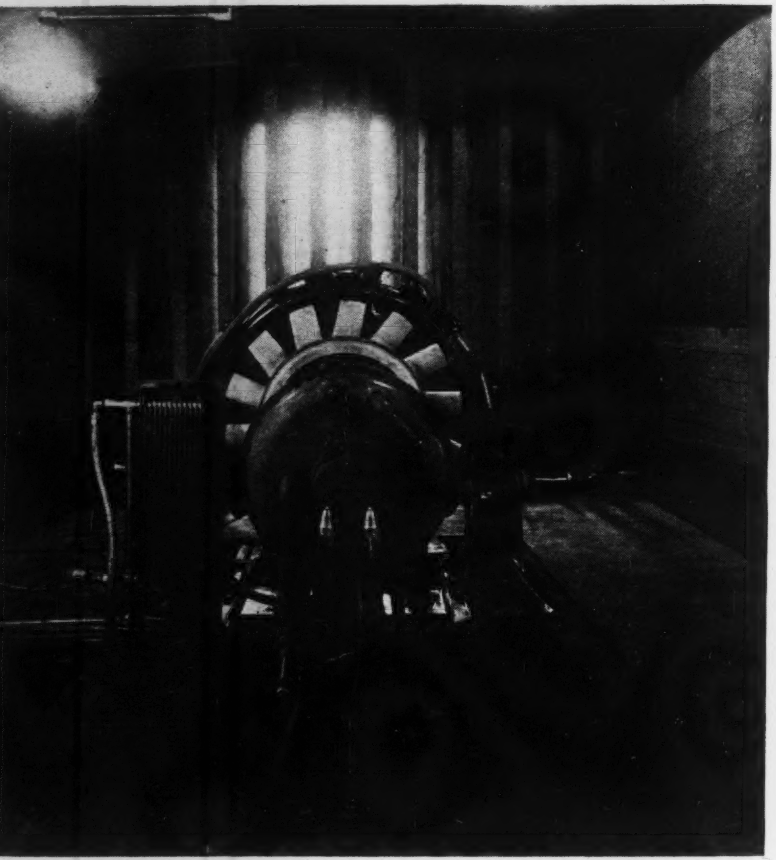


Fig. 1. Test cells have sound-absorbent material on ceilings and walls above the 5-ft. height of glazed tile wainscoting which simplifies cleaning. Ribbon walls of outlet tunnel are shown in background.

Engine Test Cells Designed For Sound Reduction

***Contents in Brief**—Despite use of substitutes to conserve critical materials, a record in sound reduction (98.5 percent between test cells and control room) is claimed for a low-cost building designed expressly to reduce noise made by high-speed gasoline engines while being "run-in" on test blocks.*

TESTING air-cooled tank engines in the open air or in an ordinary shop building puts a severe nerve strain on the test crews. The peculiarly irritating, high-pitched roar emitted by these engines is said to be "nerve shattering." And there is much of the testing to be done, because service conditions under which tanks operate are so severe that their engines have to be torn down and rebuilt frequently. After each rebuilding the engines are "run-in" gradually on the test blocks. During this period they must be watched constantly and their performance checked with precision instruments. Thus, there is an important advantage to be gained in noise-reduction provisions that: (a) enable the test crew to work under better operating conditions; and (b) decrease the interference, by reason of noise, with other activities nearby.

The problem of how to accomplish these results most effectively with a minimum use of critical materials was presented to Col. James D. Andrews, Jr., district engineer of the U. S. Engineer Department at San Francisco. Study of this problem under his direction, as described in the following, has resulted in an economical dynamometer building believed to be unusually effective in its sound reduction qualities.

In general, the good result has been accomplished by: (1) 12-in. concrete walls; (2) acoustical treatment of walls and ceiling in the cells and the control room; and (3) acoustical treatment of the ribbon walls or vanes in an exhaust tunnel 10-ft. 9-in. long.

Design features

The building, of reinforced concrete, about 45x50 ft. in plan, is divided into two engine test cells with a control room between, and a lobby or passageway through which engines move into the cells. Engines, usually arriving on motor truck or trailer, are picked up by an overhead monorail, which conveys them from the lobby into the cells and places them on the test blocks.

Between control room and each test cell is a large window with three thicknesses of shatterproof glass set in felt; the center pane is slightly inclined to damp out vibration. For sound insulation, walls and ceiling of the control room have a 4-in. lining of rock-wool batts faced with ⅛-in. thick asbestos cement, which has been perforated with 5/32-in. holes at ½-in. centers both ways. In the test cells the ceilings and the walls have the same lining as in the control room, except that glazed tile is used on the walls to a height of 5 ft. from the floor for convenience in cleaning.

For ventilation it is important to maintain a constant flow of air past the engine and to the outdoors. This flow is supplied by a 10,000-cfm. blower mounted over storage space at the rear of the control room and between the tunnels. Air enters through screened louvers in a small housing on the roof, and is distributed through a branching plywood duct into the test cells, flowing thence outward through the exhaust tunnel.

To reduce to a minimum the escape of sound with the exhaust, vanes or "ribbon walls" are set up in the tunnel parallel to the direction of flow. They are faced on both sides with the same sound-absorbent material used in cells and control room. This sound insulation is carried on a 2x4 timber framework whose open spaces are filled with rock-wool batts and provided with the same covering used on walls and ceilings of the cells and the control room. The tunnel has twelve of the ribbon walls, spaced 14 in. on centers. Each wall face has about 120 sq.ft. of sound-absorbing area. Total sound-absorbent surface of ribbon walls, side walls and ceiling of the tunnel is about 3,150 sq.ft.

Specifications, as originally written, provided that the sound insulation should consist of perforated metal with baked enamel finish, backed by glass fiber. However, these are critical materials and substitutes for both were found, as mentioned in the foregoing. The reduction of 16 decibels actually obtained in the tunnel is considerably less than the calculated absorption of 25.8 decibels which was expected to be attained with specially perforated metal and fiber glass. However, the substitutes have proved not only sufficient for all practical purposes, but it is believed that by reason of the effective design used, they have effected a greater sound rduction than any hitherto attained in an exhaust tunnel of this length.

Reduction of sound intensities

Specifications for sound intensities were written referring to points one foot inside the tunnel and one foot outside the tunnel. This provides a definite location for determining the sound reduction rate attained. Tests made by Dariel Fitzroy, of the J. L. Stuart Co., San Francisco, after completion of the tunnel, indicate that a sound reduction of 15.9 decibels is obtained between those two points, a reduction of 67 percent. The sound produced by the engine undergoing test is reduced 98.5 percent between the test cell and the control room.

In other words, acoustical treatment of the walls and ceiling of the engine test cell reduces the sound within the room 35 percent, while further reductions in its transmission through the wall into the control room eliminates enough more of the sound that only 1.5 percent of the original volume remains. Comparative results of sound intensity tests are given in the accompanying table.

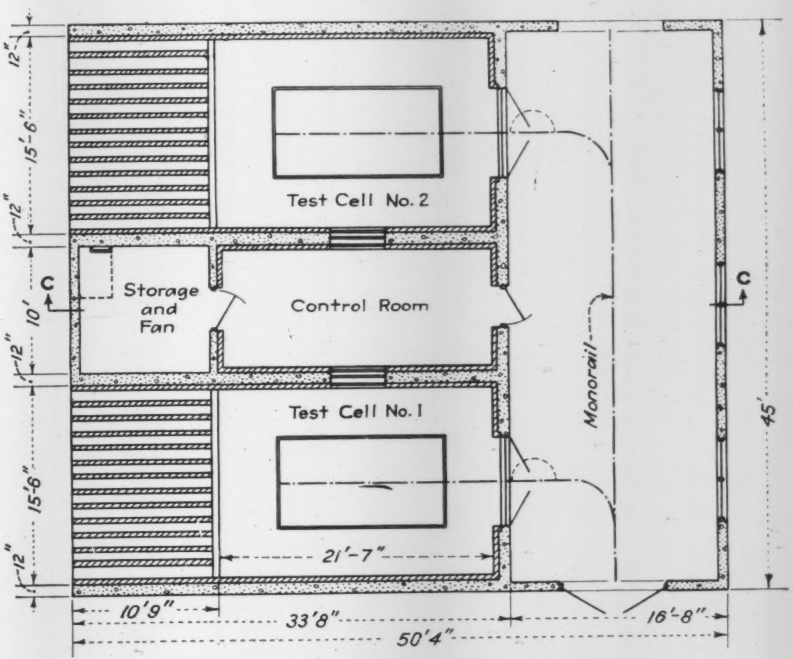
The sound level in the control room, while a tank engine is running wide open in the adjacent test cell, is so low that conversation can be carried on in ordinary tones. Thus, the operators are freed from noise-induced nerve strain and are able to concentrate, without distraction, on engine performance and the indication of the instrument panel dials in the control room.

The cost of the building complete, not including dynamometers or instruments, was less than $20,000. This cost is considered reasonable for the two highly desirable results obtained, namely, making possible: (1) constant operation of running-in motor tests in any location without interference to work in adjoining buildings; and (2) complete protection of test operators from nerve-shattering noise, thus providing efficient working conditions.

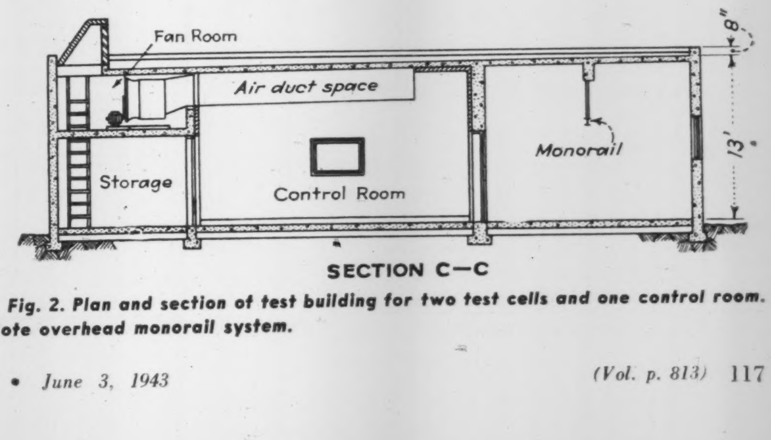
The building was designed by A. C. Volkmar and Ralph Birchard, U. S. Engineer office, San Francisco, under supervision of Lieut.-Col. Ramon C. Buell, Corps of Engineers. Construction was by J. Strizek, Stockton, Calif., under supervision of Lieut.-Col. Claus A. Tornell, Corps of Engineers, district regional engineer.

RESULTS OF MEASUREMENTS OF SOUND INTENSITIES

Spot Where Sound Was Measured	Intensity (in decibels)	Percent Reduction of Original Sound	Percent of Sound Remaining
At engine	84.7		
Test cell (one foot from discharge tunnel)	79.0	35.2	64.8
One foot outside discharge tunnel	63.0	78.6	21.4
In control room	30.0	98.5	1.5



FLOOR PLAN OF DYNAMOMETER BUILDING



SECTION C—C

Fig. 2. Plan and section of test building for two test cells and one control room. Note overhead monorail system.

Submergence Effect on Sharp-Crested Weirs

John K. Vennard
Assistant Professor of Fluid Mechanics
New York University

Roy F. Weston
Sanitary Engineer, Waste Control Laboratory,
The Atlantic Refining Co., Philadelphia, Pa.

Contents in Brief*—Data of five outstanding hydraulic workers are compared and graphs are made available that simplify calculations for determining the discharge over sharp-crested weirs. Two important problems in using the weirs to measure open channel flows are eliminated, and the use of lengthy formulas is avoided. The reliability of the wide application of the curves developed is also proven.*

A SUBMERGED, sharp-crested weir frequently proves to be a useful and economical metering device in open channels where head cannot be sacrificed. However, in using such a weir, the engineer finds it difficult to predict the effects of submergence and to select the weir formula that is most likely to give reliable results. The problem is further complicated by the forms and terms of the available submerged weir formulae which make them difficult of comparison. Both of these difficulties may be overcome by using principles of similarity in an analysis of the tests of Francis[1], Fteley-Stearns[2], Bazin[3], Cox[4], and Cone[5], which are summarized in Table I.

Because weir flow, either free or submerged, is a gravity phenomenon in which friction plays little part, similarity is governed by the Froude law and the dimensionless ratios H_2/H_1 and P/H_1. In these ratios H_1 is the upstream head above the weir crest, H_2 elevation of the tailwater above the same level when measured some distance downstream, and P the height of the weir. Thus, the application of these principles allows the effect of submergence to be shown in the dimensionless fashion of Figs. 2 and 3. In these illustrations the discharge ratio Q/Q_f or the ratio of the actual discharge to the free flow discharge is plotted against the submergence ratio H_2/H_1 for various values of P/H_1. These discharge ratios may be applied directly to the Q_f obtained from a calibration curve or from a weir formula that accurately characterizes discharge at free flow.

The tests of Francis and Fteley-Stearns were on suppressed weirs with greater channel widths below than above the weir. The wider channel downstream decreased dynamic effects (waves, undulations, etc.) and allowed some latitude in the selection of the point at which to measure H_2. In these tests velocity of approach was small enough to be negligible for most practical purposes, but when the measurements were corrected for this factor all the results of the tests may be plotted on a single curve, as shown in Fig. 2.

With the tests by Bazin and Cox rectangular channels having the same width above and below the weir were employed. Although Cox confirmed the measurements of Bazin by duplicating one of the latter's tests, comparison of their results is not easy because of different methods of measuring H_2 and accounting for velocity of approach.

Cox considered approach velocity

Cox applied the conventional velocity of approach correction to H_1 and

TABLE I—SUMMARY OF EXPERIMENTS USING RECTANGULAR, SHARP-CRESTED SUBMERGED WEIRS

Worker	Characteristics of the weir installation								P/H_1	Number of experiments.		Agreement of curves with workers data for discharge ratio		
	Type	Hght. P, ft.	Width b, ft.	Channel width		Point of measuring H_2				Total	Used in this study	Std. error of estimate "σ"	Odds against occurrence of error equal to or greater than 1% of Q_f	Probable error of mean of experiments used in this study PE
				Above weir, ft.	Below weir, ft.	Type	Dist. from weir, ft.	Dist. below weir crest, ft.						
J. B. Francis..	Suppressed	6.5	10.98 & 11.22	10.98 & 11.22	>22.2	1-1.5" pipe, transverse	18.0	0.75	2.8 to 7.7	30	30	0.0089	2.7 to 1	0.0011
Fteley-Stearns.	Suppressed	3.17	5.0	5.0	9.0±	1-4"x4"x2' trough, parallel	6.0	3.0±	3.3 to 9.7	21	21	0.0083	3.3 to 1	0.0012
M. H. Bazin..	Suppressed	0.79 1.15 1.64 2.46	6.56	6.56	6.56	....	36.0	....	0.5 to 7.7	316	112	0.0079	3.8 to 1	0.0005
G. N. Cox....	Suppressed	1.14 2.00 3.25 5.93	3.527, 1.96 and 2.00	3.527, 1.96 and 2.00	3.527, 1.96 and 2.00	2" x 8" x 8" Piezometer, Parallel	2.54 P	1.5, 0.5 and 1.0	0.7 to 29.6	689	104	0.0212	0.6 to 1	0.0014
V. M. Cone...	Contracted	4.5	1, 2, 3 & 4	10.0	10.0	2-1" pipes, transverse	3.5*	4.3±	3.5 to 22.5	757	104	0.0070	5.5 to 1	0.0005
	Cipolletti	4.5	1, 2, 3 & 4	10.0	10.0	2-1" pipes, transverse	3.5*	4.3±	3.5 to 22.5		118	0.0074	4.6 to 1	0.0005

* Channel blocked off 5.75 ft. downstream from weir.

easured H_2 by a piezometer column cated at a point 2.54 P downstream om the weir. This location is the w point of the downstream pressure ofile or Point A in Fig. 1. For wide nges of P, H_1, and P/H_1, the Cox ta plot as a single line practically incident with that of Francis and etley-Stearns, as shown in Fig. 2.

In the tests of Bazin, H_1 is the atic head and H_2 the head measured a point well downstream from the eir where the water surface was subantially horizontal. When plotted in Fig. 2, Bazin's tests yield a difrent curve for every value of P/H_1. other words, the effect of submerence depends on the *shape* of the ow picture, which for a given subergence is fixed by the P/H_1 ratio. hen P/H_1 is large, resulting in neggible velocities of approach and inimum effects downstream, the Bain curves coincide with those of rancis, Cox, and Fteley and Stearns.

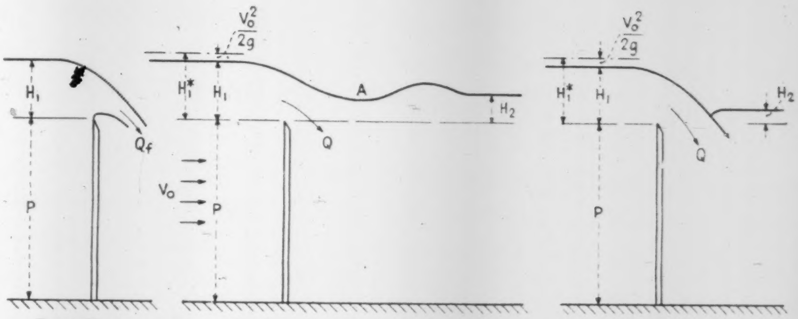
Bazin method more practical

In comparing the Cox and Bazin ethods of measuring H_2, it is evient that the Bazin method is the ore practical because special locaions and piezometers are unnecesary and because the elevation of the ndisturbed water surface downtream from the weir may be measred more readily and accurately, nd is more significant in open chanel calculations. Furthermore, the mall scattering of Bazin's results ompared to the Cox data seem to how the Bazin method to be the more eliable. Bazin's results are also more eadily usable, since they are based n the static head H_1 and do not involve the cumbersome correction for elocity of approach.

Two types of flow

It is generally known that two ypes of submerged weir flow are posible, one with a "surface nappe," he other with a "plunging nappe." he former occurs at high submerence ratios, and the latter at low ubmergence ratios. However, the recise submergence at which one ype of flow changes to the other is ot accurately predictable and it has een observed to depend upon the ethod of establishing the flow.

The Cox data show an abrupt hange in discharge ratio for small ifferences of submergence ratio as ne type of flow changes to the other. his is due to measuring H_2 close to the weir where a change in type of flow results in a large change in H_2. Bazin, however, measuring H_2 well downstream from the weir, observed no abrupt change in relationships with changes in the type of flow. Although the Cox results analyzed herein are for the surface nappe only, good agreement between the Cox and Bazin results has been noted for the plunging nappe discharge. For this condition there is no well defined low point in the water surface, as Point A of Fig. 1, for the surface nappe and the H_2's observed by Cox and Bazin are substantially the same. Thus the Bazin curves of Fig. 2 may be considered to be confirmed by the tests of Cox for the plunging nappe condition.

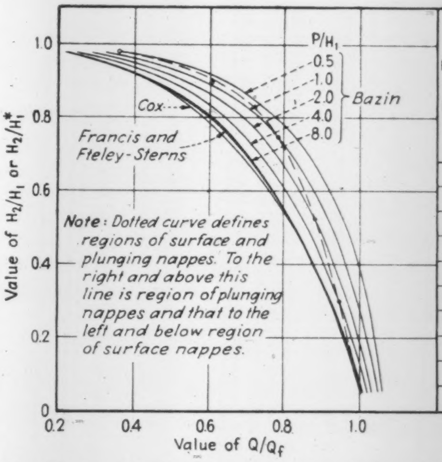


Free Flow

Surface Nappe

Plunging Nappe

Fig. 1. Three types of discharge over a sharp-crested weir are shown above. Of interest is the fact that for some values of H_1 the discharge with a plunging nappe will be greater than for free flow.



Note: Dotted curve defines regions of surface and plunging nappes. To the right and above this line is region of plunging nappes and that to the left and below region of surface nappes.

H_2/H_1^* or H_2/H_1	Q/Q_f						
	Francis, Fteley-Sterns	Cox	Bazin				
	P/H_1^* 2.8-9.7	P/H_1^* 4.5-29.6	P/H_1 8	P/H_1 4	P/H_1 2	P/H_1 1	P/H_1 0.5
0.95	0.325	0.324	0.322	0.362	0.402	0.449	0.502
0.90	0.446	0.452	0.456	0.497	0.540	0.589	0.640
0.80	0.590	0.602	0.611	0.650	0.694	0.737	0.783
0.70	0.688	0.698	0.700	0.740	0.781	0.821	0.866
0.60	0.769	0.770	0.771	0.808	0.845	0.883	0.925
0.50	0.830	0.828	0.827	0.861	0.895	0.930	0.968
0.40	0.880	0.879	0.876	0.906	0.936	0.967	0.999
0.30	0.923	0.922	0.920	0.947	0.970	0.998	1.023
0.20	0.960	0.961	0.957	0.980	1.000	1.022	1.044
0.10	0.992	0.995	0.991	1.010	1.025	1.043	1.060

Fig. 2. Graphical comparison of various studies by different workers for sharp-crested, suppressed weirs. Data for plotting curves are shown in the table.

Bazin and Cox both noted the H_2 at which change in type of flow occurred, and the Cox data, which duplicated some of the Bazin tests, gave good agreement with the Bazin H_2. A summary of the Bazin observations is plotted on Fig. 2 as a line that fixes an approximate boundary between the conditions for plunging nappe and surface nappe.

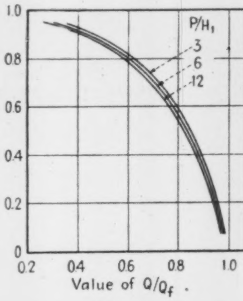
In summarizing the data of Cox, it was found that the boundary between plunging nappe and surface nappe has the same trend as that of the Bazin data and that a change in the type of flow may be expected at submergence ratios of zero or greater if P/H^*_1 is about 4.5 or less, where H^*_1 is the upstream head corrected for velocity of approach. Therefore, the curve in Fig. 2 for the Cox data is applicable to all submergence ratios only when P/H^*_1 is about 4.5 or more.

Submergence may increase flow

By a study of Fig. 2 it is seen that at certain low values of H_2/H_1 and P/H_1, the ratio Q/Q_f is greater than 1.0, which means that the effect of submergence is to increase the discharge over that for free flow conditions. This apparent paradox is easily understood when it is noted that at zero submergence a free aerated nappe cannot exist and that flow occurs under the "filled nappe" condition. For flow with a filled nappe it is well known that the pressure beneath the nappe is lower than that beneath the fully aerated nappe. This results in a greater pressure difference across the weir and produces a larger discharge for the same head H_1. This effect is still operative as the submergence increases, and it causes Q to be greater than Q_f at relatively high submergences, especially for relatively low weirs.

Contracted and Cipoletti weirs

The comprehensive tests of Cone on rectangular contracted weirs and Cipoletti weirs have been analyzed and plotted on Figure 3. Here, as in Bazin's tests, the effect of submergence varies with the P/H_1 ratio and for high values of P/H_1 results are practically coincident with those shown in Fig. 2. The influence of P/H_1 on the results of Cone is obviously small, and may have been due to the use of a relatively small basin downstream from the weir in which H_2 was measured. It is possible that in installations with larger basins that the influence of P/H_1 would not appear and that the single curve for a large P/H_1 ratio would prove satisfactory.



H_2/H_1	Q/Q_f		
	P/H_1 12	P/H_1 6	P/H_1 3
0.95	0.286	0.319	0.358
0.90	0.433	0.458	0.480
0.80	0.595	0.615	0.634
0.70	0.698	0.713	0.730
0.60	0.773	0.790	0.806
0.50	0.830	0.846	0.861
0.40	0.880	0.894	0.906
0.30	0.921	0.931	0.940
0.20	0.954	0.963	0.969
0.10	0.981	0.989	0.993

Fig. 3. Graphical summary of data obtained by V. M. Cone for sharp-crested contracted and Cipoletti weirs. Data for plotting curves are shown in table.

Conclusions

To conclude, it has been shown that all available data approaches a minimum single curve which characterizes the effect of submergence on sharp-crested suppressed, contracted, and Cipoletti weirs for large valu of P/H_1. In submerged-weir install tions of the Francis, Fteley-Stearn Bazin, and Cone types this curve ma be used for $P/H_1>3$, $P/H_1>3$ $P/H_1>6$, and $P/H_1>6$, respectivel with errors of less than two percen even when the velocity of approach neglected. The reliability and wid application of such a curve is obviou from the numerous and varied test from which it was prepared. Thus, it use to avoid lengthy weir formula should prove convenient.

The writers are indebted to Profes sor B. A. Bakhmeteff of Columbi University for his kindly criticism and helpful suggestions.

BIBLIOGRAPHY

Francis, J. B.; Experiments on Flow o Water Over Submerged Weirs; Trans.; Am Soc. of C. E., Vol. 13, pp. 303, 1883.

Fteley, A. and Stearns, F. P.; Descriptio of Some Experiments on Flow of Water Mad During the Construction of Works for Con veying Water of Sudbury River to Boston Trans., Am. Soc. of C. E., Vol. 12, pp. 101 108, 1883.

Bazin, H.; Experiences Nouvelles Su L'Æcoulement en Deversoir; 7e Serie, Tom VII, Annales des Points et Chaussees, Memoires et Documents, 1894.

Cox, G. N.; Submerged Weir as a Measuring Device; Bul. of Univ. of Wisconsin, Engr Experiment Sta. Series, No. 67, 1928.

Cone, V. M.; Flow over Submerged Weir of Sharp-Crested and Ogee Types; Journal o Agricultural Research, Vol. V, No. 23. 1916

Water-spray Cooling System For Flat Roof Buildings

A. B. Tappan
President, Water Cooling Corp., New York City

DURING HOT WEATHER the interior temperature of one-story industrial buildings can be reduced 10 to 15 deg. by covering the building with a light water spray. Partial evaporation of the water will absorb the solar heat and prevent it from entering the building. Where the building is air-cooled the conditioning tonnage requirements can be decreased by about 20 percent. Secondary advantages are positive protection against incendiary bombs and exterior fire hazards, as well as increasing the life of the roofing material by reducing the loss of volatile oils that otherwise might be driven off by heat from the sun.

Attempts have been made to achieve the same results by covering roofs with 2 in. of water, but this is not satisfactory, as the surface evaporation is not sufficient to prevent the water from becoming warm. Furthermore, the stagnant water may provide breeding areas for mosquitos.

With the spray canopy the cooling effect is not due to the water temperature, but to the solar heat being absorbed by the evaporation of the spray before the heat can enter the roof. Thus, the governing feature of a canopy is to provide the best practical covering with the least amount of water, keeping in mind that the system should operate 10 hours a day for months at a time. Water requirements for a spray canopy will be about 1/200 gal. per sq. ft. per minute.

Details of a good spray layout can best be illustrated by the system the author designed in 1939 for the roof of a new 400,000-sq. ft. blackout building on Long Island, N. Y. The air conditioning engineers calculated that the proper spray over the structure would reduce the required refrigeration capacity from 1,080 to 800 tons. Since refrigeration costs were estimated at \$200 per ton of capacity, a \$56,000 saving for refrigeration machinery was considered possible by investing \$20,000 for a roof spray system; the actual cost of the canopy was less.

As this was the first system of its size to go into service in this country, details were studied very carefully, with the idea that the system might operate continuously for four or five months without shutdown for cleaning or repairs. The spray was to put no additional wear on the roof, and the water loss was to be kept to a minimum.

The nozzles were designed with removable caps for easy cleaning and to give a 15-ft. dia. coverage with slightly more than 1 gpm. delivered at 7-lb. pressure. The height of the spray was to be less than 30 in., thus keeping the spray below the building parapet. The layout finally chosen is shown by the accompanying drawing.

Steel pipe replaces brass

Use of brass piping being restricted, steel pipe of $\frac{3}{8}$-in. dia. or larger was used. Since but from 1.1 to 1.3 gpm. of water per nozzle was to be available, special nozzles were designed as follows:

Nozzle Pressure	Height of Spray	Dia. of coverage*
4 lb.	1.50 ft.	11.0 ft.
5 "	1.75 "	12.5 "
6 "	2.00 "	14.0 "
7 "	2.25 "	15.0 "

---

* The figures are average and the spread does not include spatter.

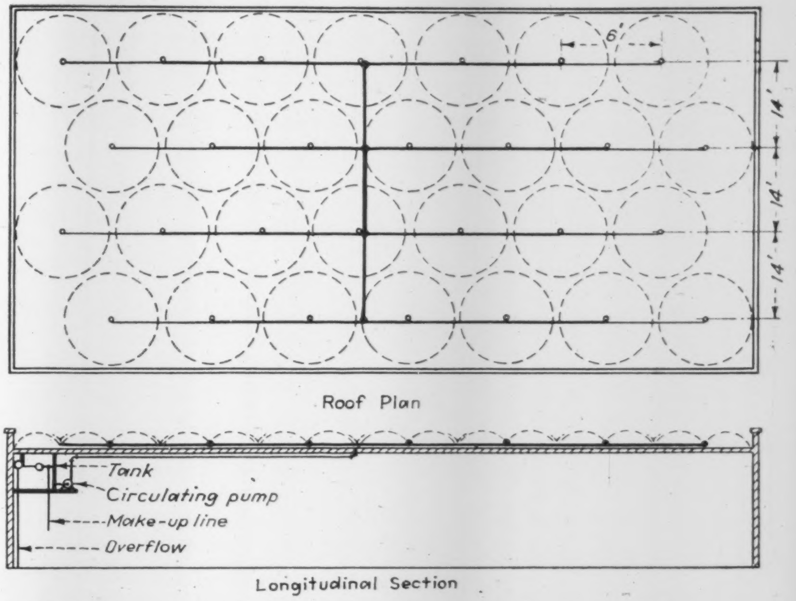
The nozzles were connected to the feed pipes through adjustable ball joints of brass. This arrangement permitted slanting connecting tees, which gave complete drainage. At the same time, the arrangement permitted an operator to change the plane of spray where desired without "breaking into" the pipe system, the only tool required for the adjustment being a screw driver. Rather than use the usual form of pipe supports, which would have had to be screwed or bolted to the roof, thus breaking the roof covering, a special redwood support was designed. It rests on wedges laid on the roofing, with the wedges providing an easy means of adjusting the pipe lines for proper drainage.

Operating costs very low

Maintenance charges with this system are negligible and operating costs are slight, as the system operates with waste water from the condensers or cooling coils for the building's air-conditioning system. The results with this installation during the summer of 1941 were so satisfactory that when nearby Plant #2 was constructed in the Fall, a similar spray canopy was installed. However, in the second installation there was one big advancement in that all distribution piping was placed above the roof; on the first job the distribution mains were below the roof with the result that they had to be covered to avoid trouble during the humid weather from condensation and resultant drip on machinery and personnel.

Other advantages of having all the main supply lines above the roof are: (1) the number of roof penetrations are reduced, and (2) the operating valves are located where the operator can watch the results when adjusting the control valves.

The result of these installations was so satisfactory that a third plant addition was similarly equipped.



Roof Plan

Longitudinal Section

Fig. 1. This spray canopy for the roof of an aircraft factory has nozzles on a 14x16-ft. staggered spacing. Each nozzle requires slightly more than one gal. of water per minute, the water being delivered at a 7-lb. pressure.

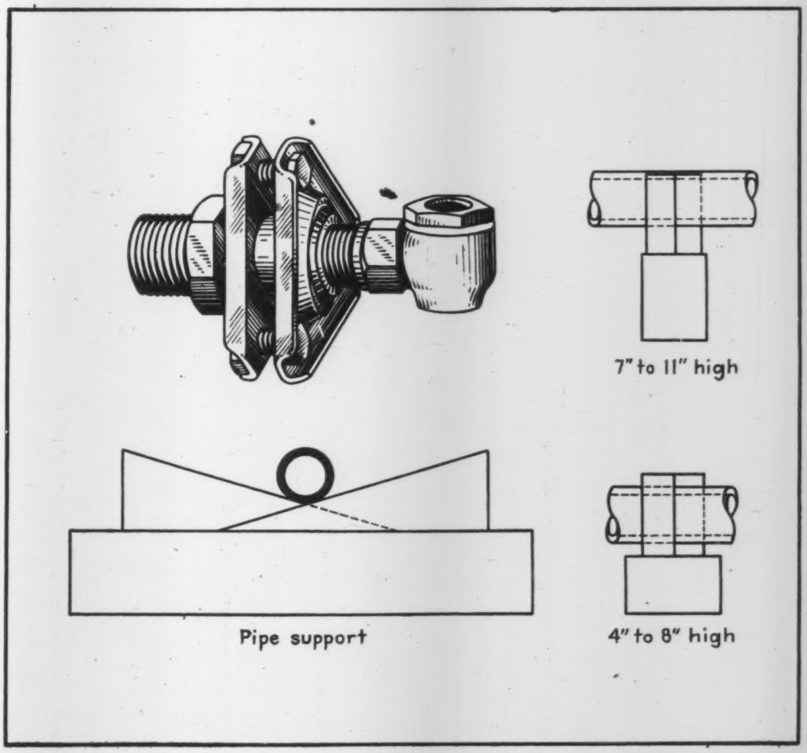


Fig. 2. Spray nozzles are connected to the supply lines by adjustable ball joints. The supply lines are carried on simple wedge blocks that prmit varying the pipe levels.

Cement-Grout Effectively Ends Maintenance Problem

Harry F. Smith
Assistant Engineer, Norfolk & Western R. R.
Richmond, Va.

CEMENT-GROUTED ballast has been used by the Norfolk & Western R. R. for construction of extensive concrete driveways and storage platforms as part of a large improvement to its West Roanoke, Va., yard and engine facilities. As a result, a big future maintenance problem is considered eliminated. Built to conserve rubber tires on the numerous motor trucks and trailers used in that area, the driveways cross many yard and shop tracks and often the centerlines of a driveway and a track coincide.

On such construction in the past the N & W has paved track areas by merely paving over the ties without special treatment to improve the track support. This practice has resulted in heavy maintenance, because track settlement and frost action misplaced and cracked the paving slab. Track settlement was particularly annoying in areas where paved ground surfaces and track grade had to be maintained at the same level. Before undertaking the work to be described, a study was made of the ways and means of eliminating similar trouble on the new construction.

Of first importance, cement-grouted ballast was considered economical and practical, since it required no skilled labor, a minimum of common labor, and only materials readily available. Another factor that determined the selection of this ballast was that railway traffic would not be interrupted during either the grouting operations or the subsequent hardening period. Also the resulting concrete slab would provide a solid permanent base capable of spreading the track load over the subgrade at sufficiently low pressures to eliminate settlement of soft ground. In addition, the gradual "digging" of the sharp ballast particles into the subgrade would be eliminated.

Ballast requirements

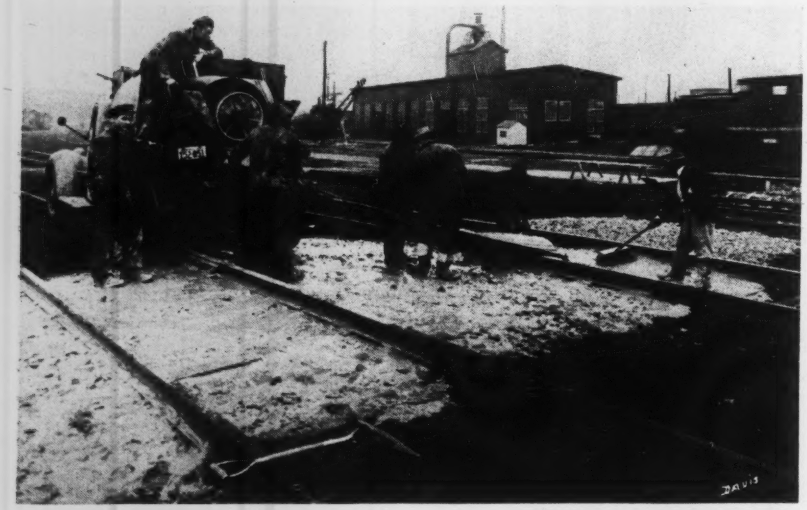
The design followed called for special graded ballast 12 in. below the bottom of tie and up to 1 in. below the top of the ties between those members, making the total ballast thickness 18 in. This entire depth was grouted to provide a solid base for the concrete pavement that covers the grouted sections of the track. The grouted width is 13 ft. at crossing and 10 ft. where the centerline of th driveway and track coincide. A 7-in concrete slab was required for th finished pavement over the groute ballast.

A ballast graded from 1½ to 2½ in and with no particles less than 1 in was specified. Good penetration wa secured in this ballast by using a grout with proportions of 1 sack o cement, 218 lb. of surface-dry sand and sufficient water to produce a consistency to insure full penetration. As a rule, the sand carried about 5 percent moisture, so that actually th mix consisted of 230 lb. moist sand and a corresponding reduction in th water added at the mixer. A relatively fine sand, all passing a No. 8 sieve, was used. (Experiments have shown that grout made with a coarser sand will not penetrate the ballast properly because the larger particles clog the voids in the ballast hindering the free flow of the grout.)

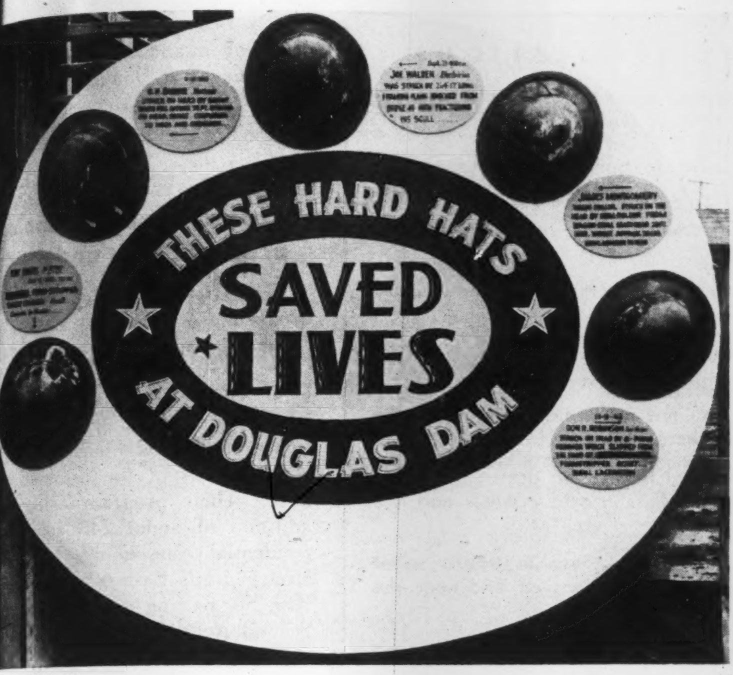
On the first operations regular ballast used by the N & W was utilized, it being somewhat cheaper than the special graded material. This regular material was graded from ¾ to 2¼ in. with a large percentage of ¾-in. size. At first it was feared that full penetration could not be obtained with this ballast because the voids were so small, but by using 2 gal. of additional water per sack of cement, penetration to the full 18-in. depth of ballast was secured.

This higher water content produced a weaker grout, which was considered sufficient for some parts of the work. Strength tests showed that effective water-cement ratios were lower than the actual amounts of water used would indicate, since the excess water bled rapidly from the grout and lowered the final water-cement ratio. Because the higher strengths that accompany a lower water-cement ratio in general were desired, for the rest of the track this coarser ballast was employed. The grout was delivered by ready-mix trucks and distributed as shown by an accompanying photograph. Total track treated was 750 lin. ft.

The writer as assistant engineer and J. P. Maloney, resident engineer, both of the N & W, were in charge of design, construction and supervision. J. P. Pettyjohn, Lynchburg, Va., and B. F. Parrott Construction Co., Roanoke, Va., were the contractors.



Distributed by chutes swung from the ready-mix trucks, the grout is worked in place by coarse fiber brooms. The surface was left rough to receive a concrete pavement finished to the top of rail.



Posted at the time-keepers office as a "life and death" reminder of the value of protection, this exhibit of smashed hard hats contributes to safety.

TVA's Safety Measures On Dam Construction

Contents in Brief*—TVA sponsors worker training and adequate safety devices to keep the accident rate low at Douglas Dam. Suggestions for safety applicable to other construction operations are given.*

INTERWOVEN with the Tennessee Valley Authority's program of dam construction is a plan of safety for the men based on the theme that the lives of workers are as important as production.

"Accidents Aid the Axis" is the slogan used as a safety incentive in conserving "manpower for warpower." Construction progress and the low accident rate on the $35,000,000 Douglas Dam project is evidence that the time taken for safety promotion increases production.

Keeping the job safe is an unusually difficult task at this time. The drain of experienced workers to man the expanded construction industry and supply workers for other war activities, as well as the armed forces, has made it necessary to employ many men inexperienced in heavy construction. Consequently a thorough, primary type of safety educational program has been used at Douglas Dam.

The safety program begins as soon as the worker reaches the project. A jumbo-sized bulletin board at the job entrance and posters at strategic points about the dam advise why and how work should be done safely. Before a new employee reports for work, he is given a lecture on the project's safety procedure and is instructed in the use of safety equipment. Necessary safety equipment is issued to the worker without cost and he is required to use it.

Five battered "hard-boiled" hats, nailed to a bulletin board beside the time office where men check in and out of the job, represent five lives saved on the project. (More than 4,700 of these hats have been issued.) The five men who wore the hats when they were accident victims are still doing their part to complete the dam on schedule to supply electricity for vital aluminum production. One of these hats was worn by an electrician foreman when he was struck squarely by a 17-ft. long 2x4 that had fallen 50 ft. The force of the blow could have split the man's head open if he had not worn the protective hat.

The safety program begins with the workman himself. He is taught to be constantly alert to the natural hazards that accompany his job. To use a job term, he must be "sold on safety," and all educational measures are designed to stimulate his natural desire to protect himself. He meets at least once a week with crew members and his foreman to discuss proper procedure and safe practice as well as the correction of unsafe conditions on the work.

Next in line for safety education is the foreman, the one direct contact between worker and management. He occupies a position of strategic importance in the safety program and unless he is convinced of its value and is prevailed upon to give it his active, aggressive support, the attitude of his men is certain to reflect his own indifference. If the workers and the foremen do not actively "preach and practice" safety the entire plan becomes ineffective even though safety devices and protective measures are supplied in generous measure.

Role of "safety officers"

Foremen meet once a month with the construction superintendent and safety officers to plan proper procedures. The safety officers are all men who know construction and are selected for ability to know the man on the job and to talk to him in his own language. At least four years construction experience, preferably in some supervisory capacity, is a prerequisite for the job of selling safety to the worker.

Accident prevention is placed upon a competitive basis. The monthly foremen's safety meetings are highlighted by "quiz programs" on safety knowledge. The accident frequency rate of each department, with the department's standing, is published

PERTINENT SAFETY SUGGESTIONS

Many safety practices used at Douglas Dam might be valuable suggestions for other projects. A few of these are listed below:

Full-time assignment of carpenter crews to building and maintaining ladders, stairways, walks and handrails.

Regular crews assigned to clean up working areas—remove underfoot and overhead hazards as they occur.

Scaffolds and walkways attached permanently to the panel forms, assuring safety and speed in form setting.

Stairways are built in sections and ready to install as progress on the job changes the working area.

A shackle with safe locking pin is provided for rapid changing of the crane hook from bucket to bucket in concrete placing.

Sale of safety shoes, and linings for hard hats at no profit; the latter relieves the discomfort of wearing safety hats in cold weather and is a health as well as a safety measure.

Ring-type life preservers are made readily accessible where water hazards exist and men working in exposed positions on and near the water are required to wear life vests.

Fire extinguishers of the appropriate type are placed at strategic points about the job. These definitely have saved lives as well as prevented untold property damage.

Penalties are imposed on supervisors or workmen found guilty of gross negligence in safety matters.

monthly. Bulletin boards are used to post other accident statistics, including the number of minor initial injuries, the number of lost-time injuries for each shift and the accident frequency and severity rates. All are classified as to cause.

A group of men representing each craft comprise the central safety committee, which meets once weekly. Prior to the formal meeting, the members form a safety patrol, touring the job to observe safety conditions and practices. Purpose of the patrol and committee is to have safety-trained workers in each craft to serve as leaders in safety procedure. Recommendations for safety improvement, made by the committee, are sent to the construction superintendent and to the project manager.

A weekly two-page bulletin combines current safety ideas of management and workmen and a monthly eight-page pamphlet is published by the Construction Safety Office and distributed to all employees. The latter particularly endeavors to bring home reasons for safe working. It also stresses the need for off-the-job care, especially in transit to and from the project over roads seriously congested when the shifts change.

With the cooperation of the safety department, the National Red Cross has conducted first-aid classes and about 250 Douglas Dam employees now hold first-aid training certificates. A class in handling and use of explosives was conducted by representatives of the U. S. Bureau of Mines and other safety instruction classes are planned for the future.

There is no way of knowing how many lives have been saved and serious injuries prevented by safety training and by protective equipment—hard hats, safety belts, goggles and other devices. Proof of the value of such safety work may be seen in the fact that the old construction "rule" of a fatality for every million dollars spent has been cut to a small fraction. With over 7 million man-hours worked to date, the accident frequency is 14.6 and the goal of 10.0 is set for the time dam is finished.

The safety program at Douglas Dam is under the supervision of Lamar Griffith, associate safety officer; and Lee W. Bagwell, Jr., and Floyd J. Campbell, assistant safety officer. The weekly *Douglas Safety Bulletin*, edited by Margaret L. Bryson, has been effective in keeping before the workmen the need for safety.

J. S. Lewis, Jr. is construction s perintendent and Lee G. Warren pr ect manager at Douglas Dam. A. Foster is district safety officer for t Tennessee Valley Authority.

Postwar city planning projects now underway

New York—An extensive rezoni program for the upper East side Manhattan has been presented to t City Planning Commission by t First Avenue Association. It wou help to encourage new building a tivities in that neighborhood after t war, officials of the association b lieve. Their program calls for addition of about 248 acres to t residential zone along the two-mi stretch from East 60th St. to Ea 90th St., putting all the land east Second Ave. in this classification.

The proposal, resulting from se eral years of study by the associati planning committee headed by F. Burdette, engineer, will be the su ject of conferences to be held soo

Chicago—The Chicago Plan Co mission proposes to ask the Ci Council to amend the ordinanc regulating new sub-divisions. Und the present law no new developmen may be approved unless they are re tangular blocks of 8 ft. to the mi one way and 16 the other, with th street 66 ft. wide and with an alle in every block.

The Commission's technical me have prepared maps showing supe blocks for most of the 18 miles o undeveloped vacant property in Chi cago. These superblocks, inclosed b wide highways, would be screened i with trees and have only narrow wind ing roads with no alleys. All throug traffic is barred. Ample areas are se aside for schools and playgrounds

Dallas, Tex.—The city of Dalla is considering a plan suggested b Harland Bartholomew, of St. Louis who has recommended that the peopl of Dallas take an overall view fo balanced development in the future and emphasizes the reviving and im provement of blighted areas.

"Cities of America, in the past have had too great a tendency t grow outward and leave the inne circle to deteriorate," said Mr. Bar tholomew, "but this condition mus be remedied."

Street Repair Expenditures Justified by Weighted Estimates

MPLE PRINTED FORMS for reports condition of street paving were lopted some three years ago by the y of Los Angeles. Subsequent ex- rience in the use of these forms has veloped improvements in this ethod of record-keeping, which is w said to provide a scientific basis r expending the available funds here they will do the greatest good, nsidering the city as a whole. In ldition to other advantages, by owing the relative urgency of work different streets, these records pro- de an effective answer to any en- eavor to put city officials under essure to get certain street work ne.

The procedure starts with report eets issued to each foreman of a reet maintenance district. The fore- an reports all pavement that is in ed of repairs or resurfacing. This port is checked by a superintendent insure the use of a common stand- d throughout the entire city in the terpretation of relative urgency. he substance of these reports is then anscribed to an $8\frac{1}{2}$x11-in. card la- eled "Report of Roadway Condi- on," which is filed for a permanent cord. Records on each card are mited to about one-quarter mile ngth of street and in no case does a rd include more than one type of reet improvement. That is, in no se does any card straddle a point here the type of street improvement anges.

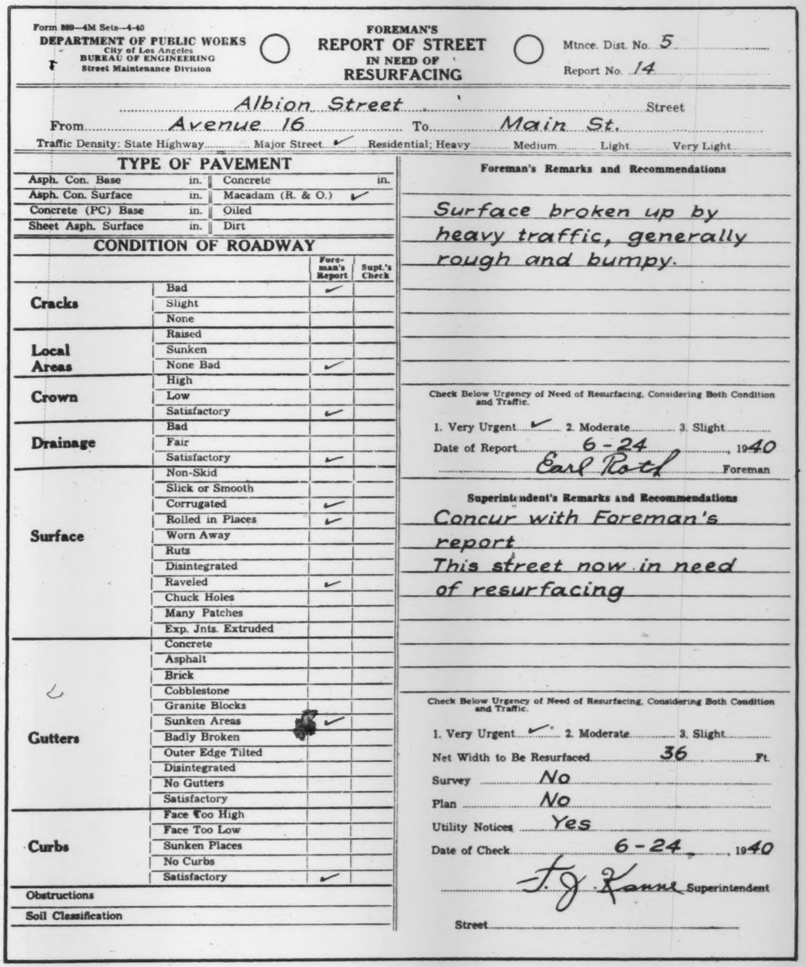
How urgency of work is judged

The urgency of work to be done a particular street is considered ith respect to (1) its extent and riousness, as well as (2) the volume traffic involved. Condition of the reet is considered under two heads: 1) the rough riding qualities as in- icated by a recording instrument nd (2) the summation of the eighted values of all the other de- cts recorded. All ordinary defects re listed on the form to remind oremen and superintendents not to overlook these in making their reports.

The record card reproduced as Fig. 2 indicates the improvement made in the method of estimating since this report system was adopted. At first, the inspectors merely put a check mark in the proper column. Later it was decided to indicate the degree of urgency by figures from 1 to 5 on the less important items, ranging up to as much as 1 to 20 on the major features. Thus, instead of merely checking a defect, the inspector sets down his estimate, within the range of the weighted scale, as to the relative urgency of the work needed. In this way the several weighted entries can be added up into an index figure for each proposed project, shown at the extreme right on the card, which is highly useful for comparative purposes.

Estimate vary only slightly

In the last two entries on the record card note the differences in estimate of the relative urgency on the



Form 889—4M Sets—4-40
DEPARTMENT OF PUBLIC WORKS
City of Los Angeles
BUREAU OF ENGINEERING
Street Maintenance Division

FOREMAN'S
REPORT OF STREET
IN NEED OF
RESURFACING

Mtnce. Dist. No. 5
Report No. 14

Albion Street Street
From Avenue 16 To Main St.
Traffic Density: State Highway ___ Major Street ✓ Residential; Heavy ___ Medium ___ Light ___ Very Light ___

TYPE OF PAVEMENT

Asph. Con. Base	in.	Concrete	in.
Asph. Con. Surface	in.	Macadam (R. & O.) ✓	
Concrete (PC) Base	in.	Oiled	
Sheet Asph. Surface	in.	Dirt	

CONDITION OF ROADWAY

		Foreman's Report	Supt.'s Check
Cracks	Bad	✓	
	Slight		
	None		
Local Areas	Raised		
	Sunken		
	None Bad	✓	
Crown	High		
	Low		
	Satisfactory	✓	
Drainage	Bad		
	Fair		
	Satisfactory	✓	
Surface	Non-Skid		
	Slick or Smooth		
	Corrugated	✓	
	Rolled in Places	✓	
	Worn Away		
	Ruts		
	Disintegrated		
	Raveled	✓	
	Chuck Holes		
	Many Patches		
	Exp. Jnts. Extruded		
Gutters	Concrete		
	Asphalt		
	Brick		
	Cobblestone		
	Granite Blocks		
	Sunken Areas	✓	
	Badly Broken		
	Outer Edge Tilted		
	Disintegrated		
	No Gutters		
	Satisfactory		
Curbs	Face Too High		
	Face Too Low		
	Sunken Places		
	No Curbs		
	Satisfactory	✓	
Obstructions			
Soil Classification			

Foreman's Remarks and Recommendations

Surface broken up by heavy traffic, generally rough and bumpy.

Check Below Urgency of Need of Resurfacing, Considering Both Condition and Traffic.

1. Very Urgent ✓ 2. Moderate ___ 3. Slight ___
Date of Report 6-24, 1940
Earl Roth Foreman

Superintendent's Remarks and Recommendations

Concur with Foreman's report
This street now in need of resurfacing

Check Below Urgency of Need of Resurfacing, Considering Both Condition and Traffic.

1. Very Urgent ✓ 2. Moderate ___ 3. Slight ___
Net Width to Be Resurfaced 36 Ft.
Survey No
Plan No
Utility Notices Yes
Date of Check 6-24, 1940
T. J. Kanne Superintendent
Street ___

Fig. 1. The foreman's report; made out in the field and checked by the superintendent.

several items. These difference however, average up so that on man's total appraisal was 46 and th other was 37, a difference of only 9

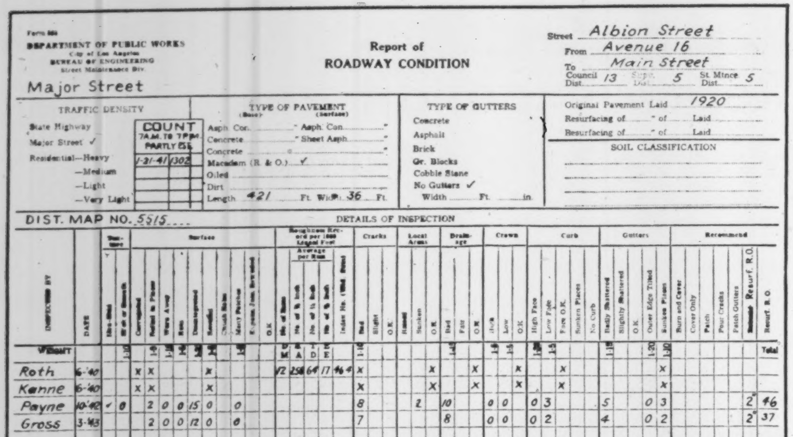
The traffic count is made by re ords kept for a series of half-hou periods. Factors which have bee derived from actual counts, made fo all the half-hour intervals in a 12-hr day, are then used to convert th count for the particular half-hour t a total for the period from 7:00 a.m to 7:00 p.m.

The extent of defects for differen average traffic counts in three di ferent classes of streets that ordinarily are considered as justifying resurfacing, are indicated in Table at left.

Perpetual inventory

The record cards, filed alphabetically by street names, provide a perpetual inventory of conditions an work done. Pertinent remarks by th foreman are copied from the fiel report to the reverse of the recor card, thus combining on a singl form a very comprehensive recor for each piece of paving.

The forms and explanation of th records were obtained from H. P Cortelyou, engineer-director, Burea of Maintenance and Sanitation fo the Los Angeles Department of Public Works.



Form
DEPARTMENT OF PUBLIC WORKS
City of Los Angeles
BUREAU OF ENGINEERING
Street Maintenance Div.
Major Street

Report of
ROADWAY CONDITION

Street Albion Street
From Avenue 16
To Main Street
Council Dist. 13 Supe. Dist. 5 St. Mtnce Dist. 5

TRAFFIC DENSITY
State Highway
Major Street ✓
Residential—Heavy
—Medium
—Light
—Very Light

COUNT 7A.M. TO 7P.M. PARTLY EST.
1-21-41 1302

TYPE OF PAVEMENT (Base) (Surface)
Asph. Con. " Asph. Con. "
Concrete " Sheet Asph. "
Concrete "
Macadam (R. & O.) ✓
Oiled
Dirt
Length 421 Ft. Width 36 Ft.

TYPE OF GUTTERS
Concrete
Asphalt
Brick
Gr. Blocks
Cobble Stone
No Gutters ✓
Width Ft. in.

Original Pavement Laid 1920
Resurfacing of " of Laid
Resurfacing of " of Laid
SOIL CLASSIFICATION

DIST. MAP NO. 5515
DETAILS OF INSPECTION

Note—See Reverse Side for Remarks

Fig. 2. The file record is on an 8½x11-in. card to which data from foremen's reports are transferred.

TABLE I.—ROUGHNESS RECORD AND INDEX FIGURES THAT JUSTIFY RESURFACING

	State Highway	Major Street		Local Street	
	Asphalt	Asphalt R&O		Asphalt R&O	
Traffic Count (vehicles)	15,000	10,000	3,000	1,000	500
Roughness Record	375	475	700	500	1,200
Index of Other Defects:					
(a) On a street without curbs	35	35	37	37	40
(b) On a street with curbs	45	45	47	47	50

Garbage Collection Services Put on Fee Basis as Operating Cost Rises

Garbage and refuse collection fees levied by three Ohio cities recently are further examples of the tapping by communities of new sources of revenue to help finance rising costs of government. The cities—Columbus, Youngstown and Portsmouth—hope to raise a total of $535,000 by their respective levies, enough to finance the service which residents formerly received free of charge.

Columbus with a population of 306,000 charges residents $4 a year for each family dwelling and each family in a multiple dwelling for collection of garbage, ashes and rubbish, with the fee payable on a quarterly basis, according to the International City Managers' Association. Business houses must pay 2c. per gallon of garbage, 10c. per barrel of rubbish and 10c. per bundle of rubbish; the fees must be paid on a monthly basis.

Collections, for which the city expects to receive $350,000 annually to match costs, are made once a week in residential districts and as often as requested in business sections. Disposal is made by incineration.

Youngstown's new collection fee, 50c. a week, applies only to garbage, which must be placed in cans of from 10 to 30 gal. capacity. Collection cards, covering periods of three months or a year, must be purchased from the city finance director; they must be displayed from an observable location, preferably a window. Business houses must pay extra fees for collection of commercial or industrial waste in excess of one 30-gal. can a week. Youngstown, a cit of 167,000, expects to receive $150,000 annually from the fee, more tha enough to meet costs.

Portsmouth expects to receiv $35,000 this year from its ne charge of 60c. per month to eac householder for collection of garbage only. Householders desiring service must buy quarterly cards from the city auditor. Ashes and rubbish are collected free of charge. Residential garbage is collected twice a week in July, August and September and weekly during other months.

Collection service for business establishments in Portsmouth, population 40,500, is on a slightly different basis. A charge of 25c. is made for each 30-gal. can of garbage, ashes or trash. Subscribers may buy any number of collections and are given punch cards on which are printed numbers from 1 to 50. As the collector picks up cans of garbage, ashes or rubbish, he punches out the numbers.

From Field and Office

WORKING PROBLEMS AND TIME-SAVING METHODS FOR ENGINEERS AND CONTRACTORS

Compressor for Painters ses Mounting for Receiver

Spray painters on the Caltech wind unnel job are being served by a andy portable rig in which prime nover, compressor and air receiver re compactly mounted as a trailer nit. A gasoline engine, with a V-elt drive, operates a two-cylinder ompressor which delivers into an 8-n. pipe welded together in a square oughnut sh[illegible]e that forms an excellent mounting for the unit as a whole. Oversize pneumatic tires make it ossible to attach the unit as a railer behind the painters' car.

A compact compressor unit for spray ainting.

Field and Office Comment

Square Root by Short Method

Sir: The article in *ENR*, Jan. 28, 1943, p. 149, by H. P. Boardman, concerning square roots is of paricular interest.

A general method of extracting any oot is based upon the binomial expansion of $\left(a \pm b\right)^n$, or $a^n \pm \left(\frac{n}{1}\right)$

$$a^{n-1}b + \left(\frac{n}{2}\right) a^{n-2}b^2 \pm$$

For instance, to extract the square oot of a number the largest integer he square of which is nearest to the given number is found. To this integer is added (or substracted) the quotient obtained by dividing the difference between the given number and the perfect square, by twice the integer already found.

To illustrate, using Mr. Boardman's problem:

The largest square in 5331.172 is 5329, which is the square of 73. Now to 73 is added the quotient obtained by dividing 5331.172-5329 by 146. This method gives precisely the same result as that obtained by Mr. Boardman.

Algebraically to obtain $\sqrt{n}$ the rule $\sqrt{n} = a + \frac{n - a^2}{2a}$ is used, where a is the square root of the perfect square nearest to n.

This general binomial method may be used to determine cube roots, fifth roots, seventh roots, and so on. To illustrate:

Since $(a \pm b)^3 = a^3 \pm 3a^2b + 3ab^2 \pm b^3$; in order to find the cube root of a number n, use $\sqrt[3]{n} = a + \frac{n - a^3}{3a^2}$. For instance $\sqrt[3]{65} = 4 + \frac{65 - 64}{3 \times 4^2} = 4\frac{1}{48} = 4.02$.

It so happens that Mr. Boardman's rule for square roots is identical with the method given above, since by his rule $\sqrt{n} = \frac{a + \frac{n}{a}}{2} = \frac{a^2 + n}{2a}$, while by the above rule $\sqrt{n} = a + \frac{n - a^2}{2a} = \frac{n + a^2}{2a}$

It must be observed that the degree of accuracy of this approximation is materially affected by the difference between the given number and the required integral power of an integer. That is, the closer the given number is to the required integral power the more nearly accurate is the result.—*Louis O'Shaughnessy,*

Blacksburg, Va.

Carpenters Used for Safety Workers

Appointment of carpenters as labor safety inspectors in the various areas into which the project is divided is a recent innovation in the safety campaign at the Sunflower Ordnance Works, Lawrence, Kan., according to Lyle E. Colbath, safety manager for the construction work reporting in the safety publication of the project. The carpenters will do nothing but safety work and they will inspect their areas for any unsafe conditions and repair the conditions found.

Among the different types of safety carpentry these labor inspectors will perform. Mr. Colbath listed the repair of scaffolds, ladders and braces of all kinds, construction of guard rails around pits and holes in floors and the checking of shoring in ditches.

The safety carpenters will work under the supervision of the safety department and superintendents.

A Ladder Designed for Safety and Greater Strength

A war-time accident prevention drive among Austin Co. employees developed a new ladder described as "shatterproof" and shown below. Instead of 2 x 4's for the sides of construction ladders, Austin field carpenters use laminated 1 x 2's to obtain the required strength. The rungs are secured between chucks and are covered by a thin nailer strip to give a finished appearance. Bolts that extend through all the laminated sections are used at each end of the rungs. Although it weighs about the same as ordinary ladders, the ladder shown is nearly twice as strong.

The picture illustrates the accepted safe hand hold used in ascending or descending the ladder.

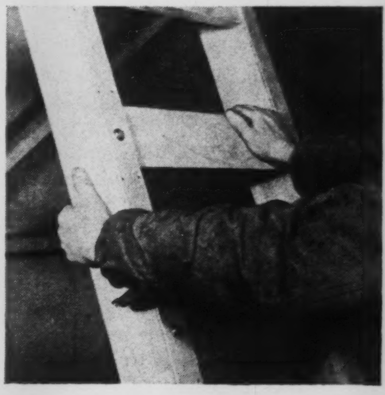


Photo Courtesy of The Austin Co.

Book Notes and Reviews

The month's addition to the engineer's reading and reference list

A Useful Dictionary

Dictionary of Science and Technology in English, French, German, Spanish—By Maxim Newmark. 386 pp. Philosophical Library, 15 East 40th St., New York. $6.

Equivalents of scientific and technical terms are given in four languages in this unusual dictionary. English terms are given first, with the corresponding terms in the three other languages. Subsequently, there are given indexes of the French, German and Spanish terms, arranged in alphabetical order, for the convenience of those using the book as an aid in translating those terms into English or into one of the two other languages.

North American Hydrology

Physics of the Earth—IX: Hydrology—Written by 24 contributors and edited by Oscar E. Meinzer. 712 pp. McGraw-Hill Book Co., New York. $7.50.

This is the ninth volume of a series of books on geophysics written and published under the sponsorship of the division of physical sciences of the National Research Council. The book is a collection of 29 splendid essays on the subject of hydrology arranged as nearly as practicable according to the hydrologic cycle. In this manner the transition from one subject to the next one becomes easy, with the result that the book makes most interesting and delightful reading. The authors are all men of high standing, well known to the engineering profession.

The introductory article defines the hydrologic cycle and generally describes its operation and its relation to life. It also gives a historical sketch of the development of hydrology, tracing it from the ancient times through the Renaissance to its present status. There follows the description of the two basic processes, precipitation and evaporation. Then the storage and transfer of the water, its flow back into the sea, and the physical and chemical work done by the water in performing the hydrologic cycle are treated in detail. The last two chapters describe the distinctive hydrology of limestone and lavarock terranes.

The book is a treatise on the hydrology of the North American continent. There are two exceptions. One is Karl Terzaghi's article on soil moisture and capillary phenomena in soils, which is a mathematical discussion of the subject and, therefore, of general application. The other is Chapter V, Glaciers, by Francois E. Matthes, which covers all continents and is a most fascinating presentation of this phenomenon.—*Reviewed by* Eugene E. Halmos, *Consulting Engineer, New York.*

Water Records

Stream Flow: Measurement, Records and Their Use—By N. C. Grover and A. W. Harrington. 363 pp. John Wiley & Sons, New York; Chapman & Hall, London. $4.

Two engineers of wide experience in measuring the flow of water and evaluating the records so obtained have brought together in this book a wide variety of information on these subjects and closely related matters. The book is of special value in that it discusses the sources of water and the physical characteristics of streams and evaluate methods for measuring and recording flow in the light of that knowledge. Methods for measuring and recording flow are described in detail as are such matters as the functions and characteristics of gaging stations, analysis of streamflow records for specific uses, and governmental control of rivers. Emphasis is laid on the relation of cost to the accuracy of results desired.

New Engineering Books

Pre-stressed Reinforced Concrete—By Kurt Billig. 248 pp. F. Billig, 151-14, 85th Ave., Jamaica, N. Y. $5.

Structural Members and Connections—Second Edition of the Hool and Kinne book, revised by R. R. Zipprodt and F. N. Menefee. 639 pp. McGraw-Hill Book Company, New York & London. $6.

The God of the Machine—By Isabel Paterson. 292 pp. G. P. Putnam's Sons, New York. $2.75.

America's Greatest Inventors—By John C. Patterson. 240 pp. Thomas Y. Crowell Company, New York. $

Mathematics Dictionary—By Glenn James and Robert C. James. 273 pp. The Digest Press, Van Nuys, California. $3.

Dictionary of Science and Technology—English, French, German and Spanish. By Maxim Newmark, 385 pp. Philosophical Library, 15 E. 40th St., New York. $6.

Theoretical Soil Mechanics—By Karl Terzaghi. 510 pp. John Wiley and Sons, New York; Chapman & Hall, London. $5.

Reports and Pamphlets

Building Materials and Structures—Report BMS95. Tests of Cement-Water Paints and Other Waterproofings for Unit-Masonry Walls (15c.) Report BMS96. Properties of a Porous Concrete of Cement and Uniform-Sized Gravel (10c.). Superintendent of Documents, Washington, D. C.

Proceedings: 3rd Annual Water Conference of the Engineers Society of Western Pennsylvania. Papers relate to inhibitors for aluminum chemical equipment, underwater paints and coatings, solubility of salts in steam at high pressure and protection against caustic embrittlement. Published by the society, Hotel William Penn, Pittsburgh, Pa., $3.

Hydraulic Models—Manual of Engineering Practice No. 25. American Society of Civil Engineers, 33 W. 39th St., New York. $1.70 to non-members.

Temporary State Commission for Postwar Public Works Planning—Interim Report. Albany, New York.

National Emergency Steels—The American Society for Metals, 7301 Euclid Ave., Cleveland, Ohio. 50c.

A Simple Plan for Electrode Stub Control—The James F. Lincoln Arc Welding Foundation. Cleveland, Ohio.

Relation of Soil-Creep to Earthflow in the Appalachian Plateaus—By C. F. Stewart Sharpe and Earl F. Dosch. Reprinted from Journal of Geomorphology. Columbia University Press, New York.

Handbook of Emergency War Agencies—Office of War Information, March 1943. Superintendent of Documents, Washington, D. C. 20c.

Montreal, Canada—Report of the Department of Health, 1941.

Connecticut State Water Commission—Ninth Biennial Report. Includes reports of the State Board of Supervision of Dams and the State Flood Control and Water Policy Commission. 1940-42. Hartford, Conn.

Missouri State Highway Commission—Thirteenth Biennial Report. Year ending Dec. 31, 1942.

New Horizons FOR WATER SERVICE

An ENGINEERING NEWS-RECORD *Report*

Lili Rethi

Synopsis of the Report

POSTWAR ACTIVITY in the field of water service has become a matter of intimate concern to municipal administrators, engineers, contractors and manufacturers. This is as it should be, for much of what will happen in the future depends on viewpoints that are established now.

When these viewpoints are integrated and objectives defined, a course of action leading to their accomplishment can be initiated. What these objectives should be, and how they may be realized, however, are matters that call for exploration. This report is designed to aid in focusing on these new horizons for water service. Following is a brief synopsis of each of the four parts in which the report is arranged.

Where we stand today—There exists a widely held misconception that everything in the postwar world is going to differ from what we have known and used before. Therefore, the argument is advanced that we should not plan now if we don't know what to plan for—and this has been evidenced particularly by lethargy in undertaking advance design and preparation of public works projects. Authoritative evidence can be cited to disprove this fallacious notion.

The present status of water service, as reflected in physical facilities and in administrative and legal policies, reveals many deficiencies and handicaps. To eliminate physical deficiencies and provide new facilities, for example, will call for an estimated expenditure of $160 to $200 millions annually for the next decade. Administrative and management policies need to be reviewed in regard to—extension of water supply outside of municipal limits, personnel relations and such fiscal matters as diversion of waterworks funds and revision of rate schedules.

Facing tomorrow's horizons—Viewed from the vantage point of yesterday's experience, it is probable that the pattern of postwar activity may unfold in four phases: (1) Appraisal—the period from now until the end of the war, during which needs are defined and methods of execution can be scrutinized: (2) Transition—the interval 6 to 12 months following the war, when adjustments to new conditions are in order and during which deferred maintenance will be satisfied while plans are completed and contracts let on major improvements; (3) Execution—the period starting about a year after peace and continuing for a decade, during which there will be an accelerating rate of new construction, introduction of new materials, equipment and technique, and the adoption of reforms in administrative, legal and fiscal policies; and (4) Stabilization—the period following a decade of major accomplishments, during which improvement and replacement of obsolescent plant will be stimulated by changes in practice as dictated by advances in technique, availability of new materials and through the development of new equipment.

Evaluating community needs—Faced with the practical problem of preparing a postwar waterworks plan, each municipality can begin immediately by examining its situation with respect to: (1) deferred maintenance and satisfaction of immediate critical needs; and (2) long-term programming of physical improvements and administrative reforms. The latter calls for extensive studies concerned with supply and quality evaluation, distribution system strengthening, the pattern of future city growth, and personnel relations, particularly those related to unionization.

Trend of technical advances—There is little probability that widely different materials and equipment for waterworks service will be immediately available following the war. This is confirmed by a survey of representative manufacturers, who support the conviction that changes will be evolutionary over a period of time. War-induced changes will be reflected simply in refinements of design. Research, much of which has been halted, should be initiated soon on questions dealing with corrosion, health protection, sedimentation, filtration, and selective adsorption.

New Horizons for Water Service

EDWARD J. CLEARY

Managing Editor, Engineering News-Record

IN EVERY GREAT CRISIS, states one of our most astute commentators, there comes a time when the future begins to impinge on the present as suddenly and unmistakably as the spring breaks through the mold of winter. Today, preoccupied with a world crisis, we nevertheless find strong evidence that the future—as represented by discussions on postwar activity—has projected itself on the present.

For those concerned with water service, this fact poses a challenge and an opportunity. Municipal administrator, engineer, contractor and manufacturer are obligated to prepare for the postwar period. But the nature of these responsibilities and the specific role to be played by any one individual or group cannot be defined until objectives are established. The challenge, then, is to define the objectives. The opportunity lies in preparing a program leading to the realization of these objectives.

To aid in the formulation of desirable objectives as well as the establishment of a program leading to their accomplishment, this exploratory study has been undertaken. It is offered not as a definition of the shape of things to come, but primarily as an assembly and interpretation of existing facts.

Concerned only with the new horizons on the domestic scene, the study is arranged in four parts: (1) Where we stand today; (2) facing tomorrow's horizons; (3) evaluating community needs; and (4) a statement on the trend of technical advances.

WHERE WE STAND TODAY • • •

A quick appraisal of where we stand today leads to the conclusion that we have not yet come to grips with the practical elements of establishing a course of action. Postwar planning is a nebulous thing—an idea that is propped up with generalities and some misconceptions.

There exists, for example, a widely held concept that everything in the postwar period is going to differ from what we have known and used before. One of the objectives, therefore, of an exploration such as this is to promote the establishment of a realistic point of view.

Bombarded on every side by announcements (imaginative and otherwise) of what the brave future holds in the way of new materials, new products and new ways of doing things, it is easy to succumb to flights of fancy regarding what the "other fellow" is going to have available in the postwar era. Thus we can easily acquire a resistance to undertake tangible, practical planning now. Why plan if we don't know what to plan for, runs the essence of the argument. This is particularly true in regard to the advance design and preparation of specifications for public works projects. Laymen on city councils and others who are in a position to initiate such activities take the attitude that definite plans made at this time would be effort wasted. Nothing could be more fallacious.

Let us take the matter of a water filtration project, for which designs and specifications are now being completed. By the time the war ends, suppose that improved pumps or other accessories are immediately available. Would this make it necessary to dispose of all the previous design work? Certainly not.

That relatively little in the way of newly developed materials and equipment should be expected when the war terminates is confirmed by the highest authority—the waterworks manufacturers, themselves; what they say is given elsewhere in this report. In fact, it may take manufacturers a long time—one or two years—before they will be in a position actively to produce new equipment. Therefore, it is safe to conclude that immediate changes should not be such as to call for any great revision in the fundamental or basic designs of waterworks plants.

Furthermore, those items that make up the major part and cost of a plant, such as excavation, piping and structures, are certain to remain about the same. Even if all the equipment and processing methods were changed, the fact is that the equipment in a water treatment plant represents only about 10 percent of the entire cost of the installation.

If plans and specifications are made now and filed away until ready for use, necessary revisions in design can be quickly made at the time when contracts are awarded. For example, it is quite possible that some new remote control devices resulting from electronic tube research carried on as a result of the war effort might be available; the addition of these facilities can be handled with virtually no effect on the fundamental design of the plant. Nor will they have any influence on site selection or other basic decisions.

Making funds available

Coupled with promoting the desirability of making designs and specifications at this time, there is the added task of convincing municipal councils to budget funds for this purpose. To place dependence on the future availability of federal aid is to fiddle while Rome burns. The job ahead requires attention now, and this calls for local initiative.

A realistic approach to postwar

planning commands attention to "first things first." And one of the first things a state or municipality must do—if it is sincerely interested in preparing for the postwar period—is to determine how local funds can be advanced for such work. With few exceptions, legal hurdles exist that prevent inclusion of such funds in the capital budget, or prohibit quick revision of the budget once it has been adopted. In the latter case it means that months or maybe a year must elapse before funds can be made available.

Equally important in considering the present status of public works postwar planning is the intimate relation between its activities and those of private industry. For example, it is important that the manufacturers of waterworks equipment should be appraised of the potential volume and type of work ahead so that they may be aided in gearing production to need. Competition for goods will be great shortly after the war and public bodies engaged in water supply functions will find it to their advantage to have a program established as soon as possible from which industry will be able to evaluate the demands to be made upon it.

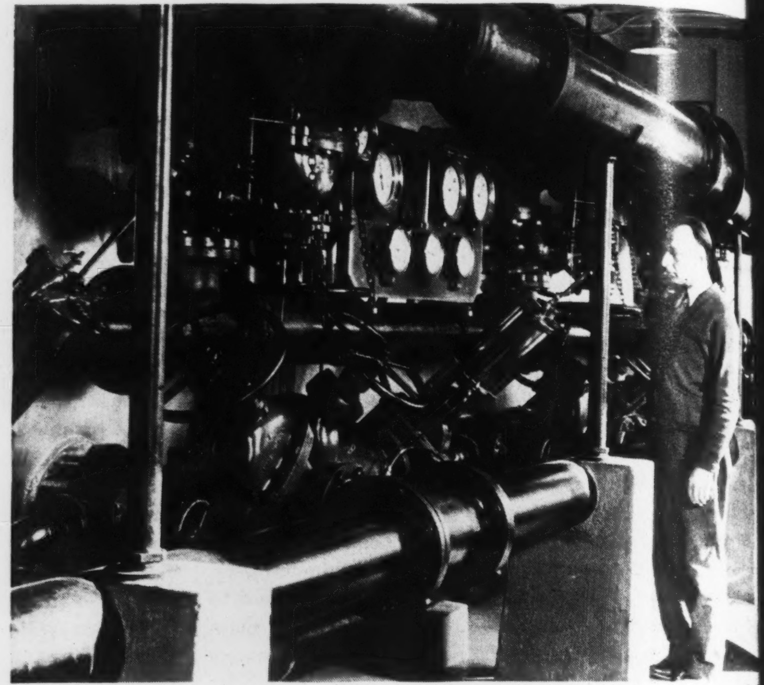
Furthermore, it may well be that a system of materials allocation based on priorities will remain in existence even after peace comes. Without definite advance planning of new domestic work, top priorities will go to foreign commitments, which can be so great as virtually to strangle work in this country.

Therefore, from the viewpoint of both aiding manufacturers to make an orderly conversion to peacetime needs as well as to establish a program on which to base a careful estimate of possible priority allocations, it is important to prepare a program of waterworks improvements.

Deficiencies and handicaps

Further evaluation of where we stand today in regard to water service is to be gained by briefly outlining some of the existing deficiencies in physical facilities, and administrative and legal policies.

So far as physical facilities are concerned, it is evident that the war halted the installation of many new municipal facilities and interrupted what promised to be an era of needed rehabilitation of existing plants. With new construction in public water supply averaging $84,000,000 annually (the average between 1925 and 1942), the approximate backlog measured in dollars can be estimated.



No evidence can be cited that revolutionary changes in basic waterworks equipment will be ushered in immediately following the war. Therefore, plans and specifications for new work can be prepared now with assurance that they will be applicable in the postwar period without major revision.

In connection with rehabilitation it must be kept in mind that not only have many plants outworn their functional usefulness but developments in recent years has made it uneconomical to operate certain existing facilities. This statement gains weight from the knowledge that the water treatment plants in our large cities date back to the 1910-20 decade, and so are in need of major remodelling.

Furthermore, shortages of material since the war started have seriously hampered expansion and, in some cases, resulted in the deferment of essential maintenance. In late 1942, for example, there were about 200 waterworks in dire need of materials to meet war-created demands. And this represented only a small proportion of the number in which improvements would have been desirable but whose needs had not yet reached an "emergency" classification.

General agreement exists that present nation-wide supply facilities are not only inadequate so far as mere volume production of water is concerned, but they are also unable to cope with problem of meeting higher quality standards as a result of public demand.

Not to be overlooked is the fact that the importance of a reliable, adequate and well-operated supply system has been dramatized by the war. And in preparing water plants to meet the abnormal demands placed upon them by war needs as well as to prepare for service emergencies, there has been uncovered a host of deficiencies that heretofore were either overlooked or underestimated.

For example, the lack of interconnection between adjoining systems may be expected to lead to the initiation of many projects of this kind in the postwar period; and further, in an effort to assure safety in water supply, an aggressive campaign of cross-connection elimination probably will be inaugurated. There is, likewise, a vast amount of deferred work to be done relating to the reinforcement of distribution systems and provisions for increased storage.

Taken all together, the elimination of deficiencies in physical facilities constitutes a program of heroic proportions. Expressed quantitatively, the size of this job is such as to call for an expenditure variously estimated at $160 to $200 millions anually for the decade following the war.

Administrative deficiencies

On the administrative and management horizon of water service, there re a host of deficiencies that command attention.

Chief among these is what Abel Wolman, president of the American Water Works Association, has characterized as "the problem of providing water supply and other utility services to people living within multiple political boundaries." He pointed out to the writer that because of new regional groupings of dense populations a new unit for service is and has been patiently awaiting political recognition for at least two decades in American history.

Aside from the fact that, generally throughout the United States, this new metropolis-city has little or no machinery for utility servicing, other than the casual, impromptu and unorganized type, responsive to the pressures of immediate needs, but no plan or rule for the future, these areas tend to sap the resources of the old cities. To provide public services for these ill-defined areas creates radically different problems of solution, of law, finance, administration and engineering, than are familiar in orthodox municipal functioning.

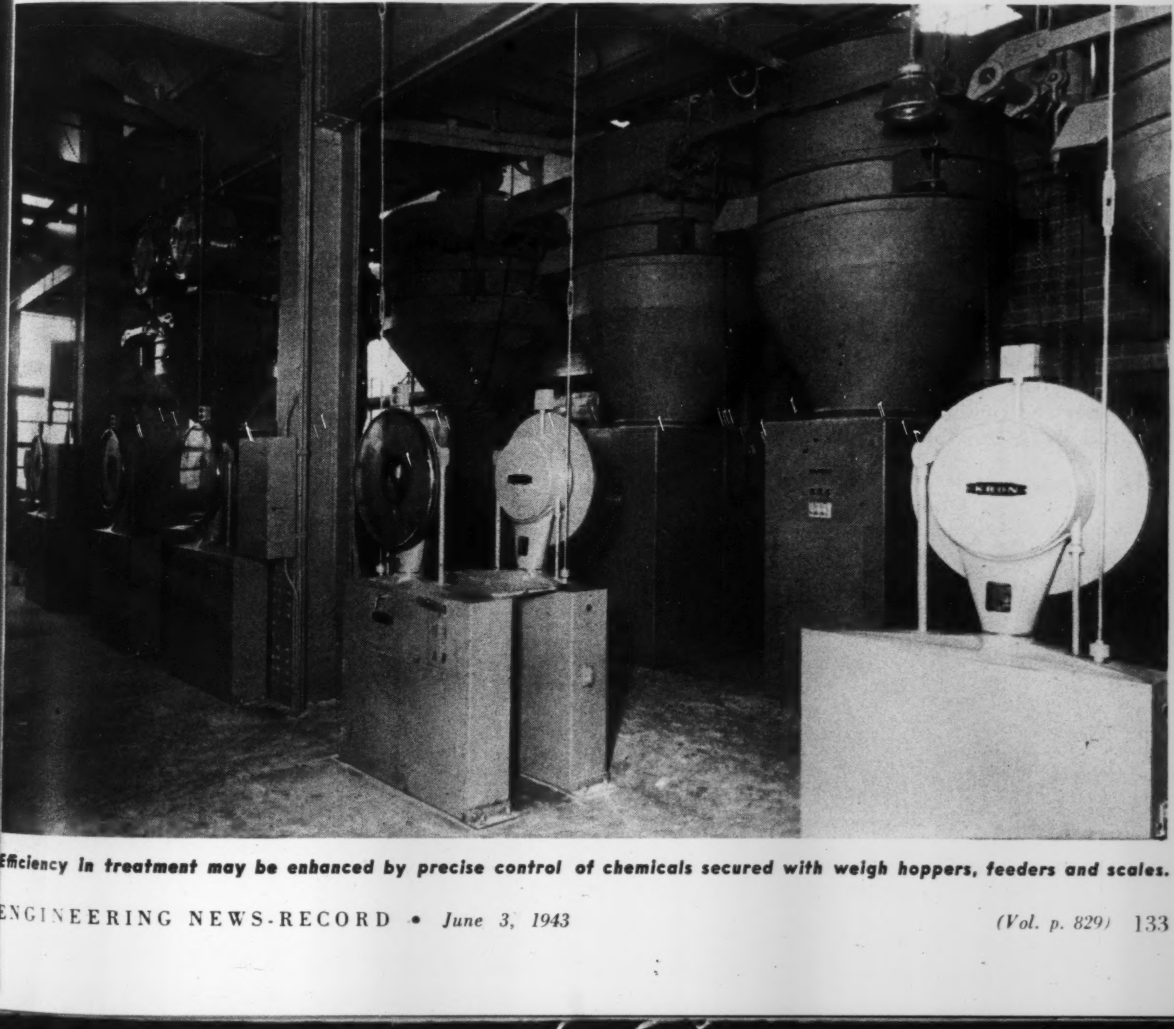
A limited number of solutions such as annexation, the formation of metropolitan districts and semi-independent corporate entities known as public authorities, have been employed to solve the problem of the regions involved, continued Mr. Wolman, but virtually none of them offers complete solutions. Instead, new and interesting problems of legal power have been created by each of these efforts. However, the test for performing a service for the public should be whether or not the service is essential for public wellbeing, rather than whether a legal precedent, implied or actual, can prevent it.

Enlarging on these views Mr. Wolman stressed the point that water must be purveyed as a social service. Posing the question of how long cities will continue to oppose extension of such service into suburban areas, he answered himself by saying that perhaps we will have to meet the problem, so far as finances are concerned, by means of subsidies.

All of which leads to this conclusion—no longer can we look upon extension of water service on the basis of how much revenue it will produce; it must be viewed from the standpoint of what service is needed and how it can best be rendered. Service areas for water supply must be realistically determined on the character of growth as it exists today, and not based on the political boundaries established in 1800. One fact seems certain, and that is that we cannot postpone indefinitely the integration of municipal, county and other relationships.

Apart from the major challenge of developing a *modus operandi* for extension of water service, there are several other aspects of present administration and management that command attention.

There is, for example, the matter of political mismanagement, as reflected in the number of employees on water department rolls. In one study of 17 cities made by the Burns



Efficiency in treatment may be enhanced by precise control of chemicals secured with weigh hoppers, feeders and scales.

& McDonald Engineering Co. a few years ago it was revealed that there is a remarkable range in the number of employees per 100,000 population, varying from 58 to 192. While some variation is expected, nevertheless a variation of over 3 to 1 does not appear justified.

Mentioning employees opens the broad question of personnel problems in public service. Politics, rather than merit too often rules in the selection of employees, and this results not only in inefficiency but a general weakening of morale throughout the entire departmental structure. It may be that the extension of tenure acts and licensing would help to correct this situation.

In connection with personnel policies, the situation today is such that a definite stand must be taken on the question of labor unions. Certainly, the public waterworks employee deserves and will demand that he have an opportunity to present his grievances and be assured of a fair deal at the hands of his employers. Therefore, those engaged in waterworks service as employers must face the issue of developing an attitude and policy in regard to unionism. And this policy, as is developed later, must be other than simply anti-unionism.

In places where dissatisfaction exists with management it should be kept in mind that as a general rule, the most satisfactory and economical operation of a municipality-owned water property can be obtained through the management by a utility board (three to five members). These boards are generally elected or appointed for a term of office greater than that for other classes of city officials, thereby insuring a greater consistency and continuity of policy. With this longer term of office, these utility boards are freer from political control and, for that reason, are more likely to attract to their membership the more capable business men of a community.

Some fiscal reforms

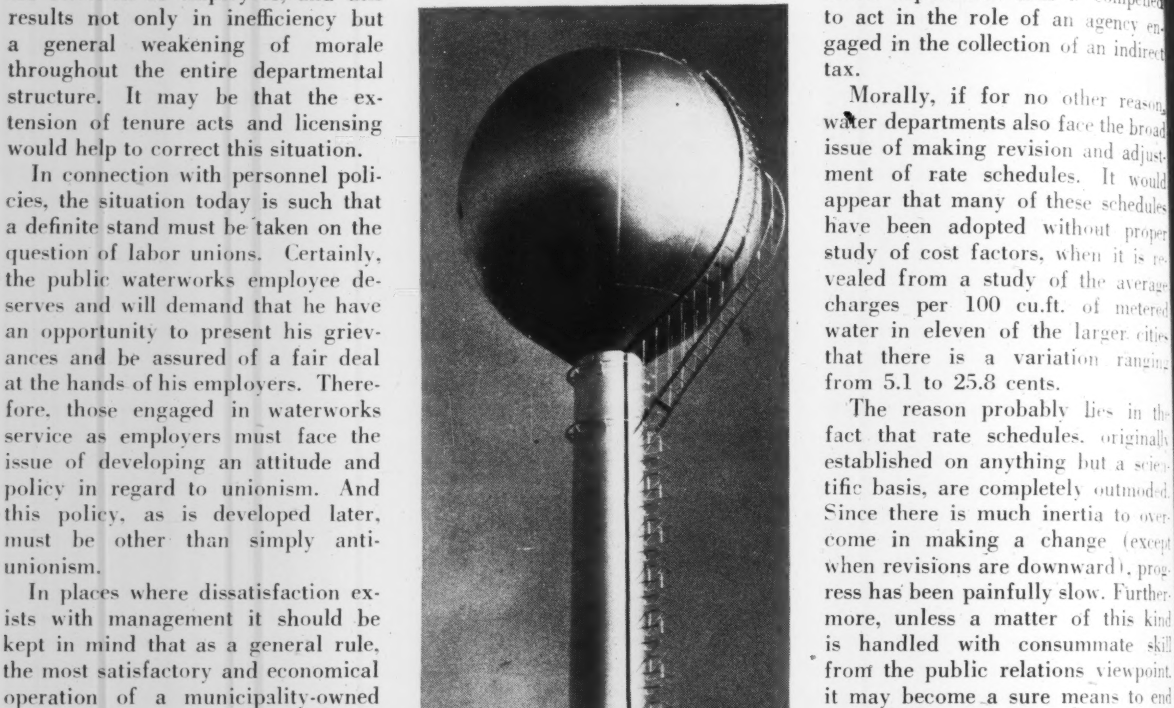
Among the fiscal problems that lay claim for attention is the widespread practice of taking waterworks department revenues and adding them to the general funds of the municipality. This practice denies to the waterworks utility the opportunity to build a reserve fund from which it can draw for improvements as needed, or to reduce outstanding obligations.

Naturally, all attempts to prevent diversion of waterworks funds meet with the strongest political opposition, because once the municipal treasury loses the income from the water department it means an increase in the general tax rate. The water department thus is compelled to act in the role of an agency engaged in the collection of an indirect tax.

Morally, if for no other reason, water departments also face the broad issue of making revision and adjustment of rate schedules. It would appear that many of these schedules have been adopted without proper study of cost factors, when it is revealed from a study of the average charges per 100 cu.ft. of metered water in eleven of the larger cities that there is a variation ranging from 5.1 to 25.8 cents.

The reason probably lies in the fact that rate schedules, originally established on anything but a scientific basis, are completely outmoded. Since there is much inertia to overcome in making a change (except when revisions are downward), progress has been painfully slow. Furthermore, unless a matter of this kind is handled with consummate skill from the public relations viewpoint, it may become a sure means to end an otherwise promising career in waterworks management.

When rate charges are under discussion that will undoubtedly bring up the matter of what to charge for water delivered to suburban areas and to industries outside the city limits; this is a vexing question for



Elevated water storage facilities reduce pumping costs and improve reliability of distribution.

Chicago Bridge & Iron photo

which no equitable arrangements have been promulgated that are satisfactory either to water purveyors or to the buyers. Not to be overlooked in this matter is the question of water supply service as well as rates to mass housing projects, many of which will be developed in the postwar era.

If any excuse is needed to open the question of rate revisions, it certainly will exist in regard to industrial services installed during the turmoil of the war emergency. Hasty and sometimes ill-advised decisions that were made so as not to impede war production demands necessarily will call for review.

FACING TOMORROW'S HORIZONS • • •

Tomorrow's horizons viewed from the vantage point of yesterday's experiences lend credence to this assumption: The pattern of postwar activity in the field of water service might unfold in four phases—(1) appraisal; (2) transition; (3) execution; and (4) stabilization. (See accompanying time-table). The first three phases may be expected to cover a period of twelve to fifteen years.

We should consider that we are now in the first phase, which will continue until the end of the war. This period is one of appraisal, or orientation, in which means and methods of accomplishment can be scrutinized. Progressive waterworks administrators, engineers and manufacturers already are shaping future plans, and as time goes on there will be an acceleration of such activities.

Specifically, the accomplishments of this period should be the determination of physical needs (both immediate and long-range), coupled with the formulation of suggested reforms in administrative, fiscal, and legal policies. Once agreement has been reached as to what should be done for the correction of physical deficiencies, preparation of designs and specifications for projects can be inaugurated. However, the promptness with which consulting service can be hired, and sites selected and purchased will depend largely on the availability of funds for this purpose. Therefore, steps must be taken to see that the municipal budget includes provisions for capital expenditures or that the budget procedure can be revised to provide such funds quickly.

Less demanding, but quite important, is the drafting of such reforms in administrative, fiscal and legal policies that will contribute to more efficient and economical water service. This involves an educational program directed first to those officials who determine policies in order to convince them of the wisdom of the suggested changes and then to the public at large in order to win their support and approval.

Transition period activities

When the war ends we enter the second, or transition period. This will cover a time interval variously estimated at 6 to 12 months during which readjustment to new conditions are in order. In this period there will be the immediate need for making repairs and catching up on deferred maintenance, but the volume of accomplishment, as measured in dollars, may not be great.

Under the most propitious circumstances, including gradual demobilization of the army and a slow tapering-off of industrial work, the 6 to 12 months "breathing spell" may be used to good advantage. During this time those municipalities that have completed the major work on design and specifications for new projects should be able to complete all details preparatory to letting contracts.

It might be expected, too, that in this period the federal government will reach a decision concerning aid to municipalities. If it is decided to advance loans or grants it would then be possible for communities who are eligible for such aid to make application and conform with such necessities as are required. Furthermore, following the establishment of a federal-aid policy it will be possible for municipalities more definitely to outline their long-range program of improvements and perhaps even advance the time of their construction.

Also, it is quite likely that during this period there will be opportunities to begin the introduction of desirable changes in administrative, fiscal and legal policies that heretofore were simply under consideration as desirable objectives.

Likewise, in this period, we are apt to witness a frenzied state of activity on the part of those municipalities who previously had failed to prepare themselves for postwar construction. This will create a great demand for engineering services and in cases where communities are un-

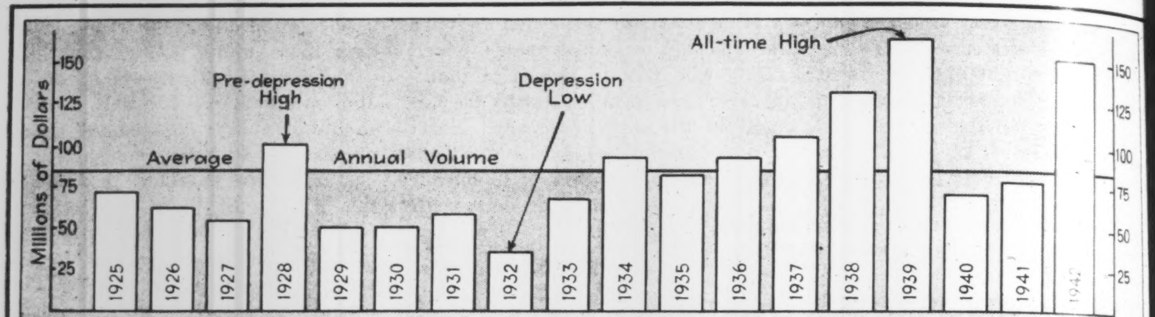
TIME-TABLE OF WATER SERVICE ACTIVITY

I. Appraisal Period (Now until end of war).
- Determination of needs: Immediate and long-range.
- Preparation of designs and specifications for projects.
- Formulation of suggested reforms in fiscal, administrative and legal policies—an educational program, first for policy-making officials and then for the public at large.

II. Transition Period (6 to 12 months after peace).
- Satisfaction of deferred maintenance.
- Completion of all details preparatory to contract letting on major construction.
- Introduction of changes in fiscal, administrative and legal policies.
- Adjustment of activities to conform with necessities for securing grants-in-aid and adoption of long-range program.

III. Execution Period (for about a decade).
- Construction activities under way.
- Revision of long-range plans to conform with stabilization of community growth, new developments, and availability of equipment.
- Application of research findings to practice.
- Adoption of fiscal, administrative and legal reforms.

IV. Stabilization Period.
- No further acceleration of construction rate.
- Replacement of inadequate plant and equipment.
- Changes as dictated by advances in technique and equipment.



Waterworks construction volume for each year from 1925 to 1943, and its relation to the average annual volume.

able to secure the services of competent, qualified consultants, the result will be the construction of inadequately designed and expensive facilities.

Third phase—execution

The third period, the start of which is not to be so plainly identified as the first two, will be one of execution. Although this passage from the transition stage into the period of accomplishment may be imperceptible at first, it will gain momentum rapidly. And for the next decade there should be an accelerated rate of new construction — improvement plans will have been formulated, designs completed and a policy of federal or other financial aid may be in operation.

Important changes in practice as well as equipment may be expected to evolve. Manufacturers not only will have had an opportunity to develop new products but they likewise will be in a position to exploit them to fullest advantage. Stabilization of both materials and labor costs can be expected and this should act as a stimulant to new construction ventures.

During this period waterworks administrators and engineers will be engaged in the revision of long-range plans to conform with stabilization of community growth, the pattern of which should then be free of the temporary distortions caused by the war.

Also in this period it should be expected that progress will be made in the adoption of such administrative, fiscal and legal policies as heretofore were recommended.

After this decade of expansion and concentrated accomplishment, it may be presumed that there will be no further acceleration of the waterworks construction rate. Instead we should envision a stabilization period, one reason for which will be the probability that a majority of cities will have reached a state of maturity.

This does not imply that expenditures for water service will terminate. Instead it might be expected that major activity will be directed toward improvement and replacement of obsolescent plant and equipment. Likewise, as time goes on there will be changes in practice as dictated by research, advances in technique and development of new equipment, all of which point to continuing activity and relatively high volume in waterworks construction.

Waterworks construction volume

As an aid in charting the quantitative range of future activity, it may be useful to examine past performance in the construction of waterworks facilities.

Data compiled by *Engineering News-Record* shows that for the eighteen years from 1925 to 1942, new waterworks construction averaged only $84,000,000, a year. In the depression decade from 1931 to 1940, when federal financial aid was available, public waterworks construction averaged only $89,000,000, which was above the 18-year average, however. The highest volume of construction, $163,000,000, was achieved in 1939; the lowest was recorded in 1932 when the total was only $35,000,000. Amounts and variations of expenditures for the last eighteen years are shown in the accompanying graph.

As to future volume of new construction, one estimate places this at about $220,000,000 annually for the next decade. Of this amount some $90,000,000 would be required to provide for anticipated population increases, another $80,000,000 would be spent to eliminate deficiencies in existing supply and distribution systems, and finally new housing would call for about $50,000,000 to be spent on added distribution facilities.

Regional development

Perhaps the most compelling problem that must be viewed when facing tomorrow's horizons lies in the development of a wider acceptance of the principle, and eventual adoption of a regional concept for water service.

Limited potential sources of supply, the degradation of existing sources through pollution, and the high cost of developing new supplies, are convincing evidence that individual municipalities cannot continue to ignore the advantages of joint action and cooperation. Some of the obvious reasons why the acceptance of these advantages has been painfully slow may be cited as follows:

(1) Regionalization of water supply must cope with the fact that there are both public and private companies operating in this field, and this introduces a number of complications, as is always the case when private and public bodies are engaged in identical services.

(2) Development of major water sources generally involve interstate relations, and this in turn calls for approval by the federal government. There is, of course, much resistance to any extension of federal participation in state or local affairs. Furthermore, devices heretofore advanced to provide for mutual agreement on interstate water problems, such as contracts that provide for voluntary cooperation, have not proven successful in practice.

(3) Competition among cities trying to grow bigger by providing attractive facilities to industries, of which water supply is one, is not conducive to participation in joint

ndertakings. Cities will not share eir supply facilities with others, for ar that this would dissipate superior dvantages. Even in the face of posble bombing attacks, cities have own resistance to interconnect xisting supplies although there could e no denial of the security advanges to be obtained from such an rrangement.

The advantages of joint action providing water-supply facilities hould be self-evident. Nevertheless, ast experience indicates that a long eriod of education is ahead, in order "sell" and promote cooperative nterprises of this kind. Legal comlications, of course, are very great. ut, as stated earlier, these are not nsurmountable if we accept the docrine "that the test for performing a ervice for the public should be hether or not the service is essential or public wellbeing, rather than hether a legal precedent, implied or ctual, can prevent it."

In many of the European counries the present status of regional evelopment in water supply indiates that they recognize its advanages and have gone a long way oward overcoming the difficulties atendant upon such arrangements. Perhaps this reflects the attitude of countries that are more mature than ours in the utilization of their natural resources. Eventually, however, the United States must approach this maturity of outlook, and with it a sense of realization that water resources are limited. In this connection, the lessons learned with the Tennessee Valley Authority river development program may furnish the answers to some questions.

EVALUATING COMMUNITY NEEDS • • •

Thus far, the report has dealt largely with generalities. The following section is concerned with the specific business of making a plan for a typical community.

Many waterworks men may have reached the stage where they subscribe to the principle that postwar planning is desirable, and they will agree that something should be done. But what? And how do you start?

Let us begin, therefore, with a working definition: Postwar waterworks planning involves first the development of an orderly *presentation* of things to be done, coupled with an attempt to *schedule* the time and manner of their doing. Now this definition falls far short of what the master strategists may have in mind, but it does state the basis for a common starting part leading to a practical course of action.

Next in order is acceptance of the philosophy that transition from a war to peacetime economy with the consequent period of readjustment that will follow, make it desirable to look upon the execution of water service improvements as falling into two classifications: (1) deferred maintenance, which must be undertaken first to satisfy immediate critical needs; and (2) construction of major improvements and initiation of administrative reforms. (See accompanying check list of water service needs).

Needs of the moment

Deferred maintenance and the satisfaction of immediate critical needs is a logical activity for first attention. In the readjustment period, covering about one year, materials and equipment probably will not be abundant.

AMERICAN CONCRETE & STEEL PIPE CO.

nstallation of new supply conduits and strengthening of distribution system facilities by means of interconnections will onstitute an important part of postwar activity in the field of waterworks construction.

But it should not be too difficult to get those things needed for purely repair and maintenance needs.

War conditions, resulting in the curtailment of materials and manpower have piled up a host of "odd jobs." All of these must be taken care of, regardless of future major improvements. Therefore, a listing of these stop-gap activities is in order, comprising in large measure those things that should have been done "yesterday."

Such a list would include: Meter repairs; painting of hydrants and other exposed structures; replacement of worn valves; machinery repairs; minor extensions to service; and rehabilitation of water department structures.

Long-term programming

Plans for correcting deficiencies in physical facilities and the introduction of reforms in administrative procedures—all of which are long-term improvements — constitute the second and most important part of the postwar program.

In this regard the waterworks man should: (1) evaluate what the community now has in the way of water service; and then (2) determine what is needed to reach such goals as he believes should be established. Invaluable help in this direction will be secured by reviewing the recommendations of the Board of Fire Underwriters and through consultation with competent consulting engineers.

The establishment of goals or objectives, of course, is a matter of individual selection for each community, depending on such factors as: Present condition of physical facilities; anticipated future requirements; and availability of finances. In general, however, water service in each community might be examined on the basis of the accompanying check-list.

A more detailed analysis

While most of the matters suggested for examination in the check-list need little further discussion, it may be profitable to enlarge briefly upon the significance of several items.

If, for example, there is a possibility that new sources of supply should be explored, it cannot be emphasized too strongly that the time element be considered. The development of new supplies invariably must be viewed as an undertaking that requires years of preparation during which progress is painfully slow. In fact, the development period for a water supply quite frequently covers an entire decade; therefore, it would not be too early to start immediately in planning for future projects.

A few examples can be cited to prove this: The Owens Valley aqueduct serving Los Angeles was under development for nine years; the Colorado River supply was in the study stage for about five years; expe ences in New York City have demo strated that it takes a period of t years from inception of a new proje to its completion; and in the case the Hetch Hetchy project to serv San Francisco it was not until tw decades after the undertaking w first planned before it became a actuality. These historical facts a presented merely to caution thos who might fail to appreciate that th future, so far as water supply need are concerned, quickly creeps up int the present.

CHECK-LIST OF WATER SERVICE NEEDS

Supply

Adequacy: Is there a need for the development of new sources; is it desirable or possible to promote interconnections with neighboring towns?

Quality: Is there need for better or additional processing (softening, for example); what improvement in treatment facilities can be made to secure greater efficiency or lower cost of operation?

Distribution

Analyze the system to reveal deficiencies in:

Pressure and quantity

Pumping and storage facilities

Valves and gate controls

Cross-connection elimination

Leakage control—(waste water survey)

Loss of capacity (cleaning and lining of mains)

Administration

Adjustment of financial policies to conform with new demands

Rate schedule adjustment (metering, industrial charges outside the city and charges for housing developments)

Personnel policy (licensing, tenure of office and unionization)

Supervisory matters (staffing, record and mapping, public relations policies, repair and emergency organization)

Political relationships—integration of municipal, county and perhaps state units to provide a unit of operation that is not restricted by historical boundaries or local political concepts.

What is good water worth?

For those who may be concerne with water quality improvement fron the standpoint of its economic worth recourse should be had to an articl published in *Engineering News Record* on October 14, 1937, p. 641 under the title "What Is Good Wate Worth?"

In this article Arthur L. Shaw and E. Sherman Chase, partners of Metcalf & Eddy, consulting engineers Boston, place a dollars and cents value on quality characteristics based on an analysis of the economic loss resulting from impaired quality While their conclusions necessarily were based on limited data, nevertheless the information they furnish is a rough yardstick with which to gage the benefits of good water.

In their appraisal of the health protection value afforded by proper purification they draw upon the experience of Olean, N. Y., in 1928 in which 21 deaths occurred among 238 cases of typhoid, the claims for which made it necessary for the city to pay some $425,000. If the Olean experience can serve as a yardstick, any municipality responsible for waterborne typhoid is potentially liable for damages equivalent to about $20,000 per death. Making the further assumption that the average annual "saving" in typhoid deaths in any one community due to pure water is 15 per 100,000 population, a safeguarded water supply can be valued as equivalent to the expenditure of $300,000 annually.

Messrs. Shaw and Chase then go on to analyze the financial valuation of the physical and chemical qualities of a water supply so far as the removal of undesirable constituents such as hardness, taste, corrosivity, iron and color is concerned.

Their conclusions are summarized

the accompanying table. Using ese figures it is possible to make rough analysis of the economic orth of improvements of a particu- r type.

How will the city grow?

Also important in estimating fu- re water supply requirements in the ng-range program is an attempt to aluate the future position of the ty. Estimates are needed in regard population growth or decline, in- strial expansion or retrenchment d any other shifts that may affect e functioning of the municipality d consequent demands for water.

For example, students of urban ends have long insisted that many f our cities must come to the reali- ation that their boom days are over d therefore they should plan for aturity rather than for expansion. n planning for maturity, however, must not be overlooked that pro- isions for an ample and reliable ater supply will exert a favorable fluence on future growth.

In this connection it is of interest consider the statement of Homer oyt of the Chicago Plan Commis- ion who discussed the postwar ructure of cities in the *American ournal of Sociology* for January, 943. Says Mr. Hoyt:

"At the close of the war, 9 to 13 illion men in the armed forces and 0 million workers in war factories ill form a great mobile population hat will be ready to move to any city romising jobs. A great number of dustries will, of course, remain tied o old locations and will resume their rewar types of manufacture. How- ver, many new well-located war fac- ories suitable for conversion into eacetime production will draw indus- ries away from obsolete plants."

"A vast reshuffling of plant loca- ions will in turn cause great shifts in he sites to be selected for the new ousing. Since three-fourths of the ew war plants are located within the etropolitan areas of cities with a opulation of over 100,000, the effect f postwar industrial migration will ot be the establishment of new cities ut the strengthening of some metro- olitan districts at the expense of thers."

This statement clearly emphasizes hat a potent factor in the develop- ent of any plan is an evaluation of ar-induced changes on future city rowth. Perhaps the best help now available in a study of this kind are the prognostications of Philip M. Hauser, assistant director of the Census Bureau. Using data obtained from the OPA sugar-rationing program and applying statistical methods of extrapolation (projecting past trends into the future), Dr. Hauser makes the prophesies that appear in the tabulation on the adjoining page.

Areas designated by the letter "A" are those that are enjoying a rapid wartime growth after steady population increases in the 1920-30 and 1930-40 period. These areas may be expected to retain a good share of their gains.

The "B" areas are spectacular boom towns. Their populations have grown recently by leaps and bounds, though prior to that time increases had been fairly slow. Population increments may be temporary unless these cities can convert after the war.

The "comeback" group is identified by "C". The war has robbed these areas of population, or slowed the rate of increase almost to a standstill. But on the basis of past performance, they will recoup after the war.

Last is the "D" group. The fate of these areas is dubious, for they show neither wartime gains nor impressive prior peacetime gains.

ESTIMATE OF ECONOMIC LOSS RESULTING FROM IMPAIRED QUALITY OF PUBLIC WATER SUPPLIES

Type of Impairment	Annual loss per mgd. water consumed
Sanitary quality	$20,000 per death from water-borne typhoid
Color	$200 per ppm. over 10
Turbidity	$400 per ppm. over 5
Corrosiveness	Must be computed for each case in one instance the cleaning cost averaged about 9 c. per lin. ft. and if this were done every three years it would mean an average annual expenditure of 3 c. per ft.
Hardness	$150 per ppm. over 100
Iron and manganese	$1,000 per ppm.

Personnel policies

Quite apart from the technical phases of postwar water service, but a matter that commands the most careful consideration on the part of water department administrators is personnel relations and policies. And this invites particular attention to the issue of labor unions.

The time has passed when administrators of public water supply organizations can advance the best interests of the service simply by ignoring the question of unionization.

One of the most arresting statements on the subject of labor unionization in the field of public service has been made by Gordon R. Clapp, general manager of the Tennessee Valley Authority. He declares that unionism among public employees is no longer an interesting theory but an accomplished fact. And he summarizes the situation as follows: Public employees, like other groups of citizens, have felt the impact of current trends in the cost of living; they are not content with static wage levels; they have not been unobservent of the unparalleled growth of employee-union participation in private enterprise; and they refuse to live with the threat of job insecurity.

Furthermore, points out Mr. Clapp, already there is increasing emulation by public employees of the methods and forms used by employees of private industry in their approach to labor relations. As far back as 1939, when an accurate survey was made, some 15 percent of all public employees already were members of unions.

"If we have the good sense to remember that public employees are human beings no different from em-

GROWTH STATUS OF CITIES IN THE POSTWAR PERIOD

Predictions based on a recent study of population trends made by Philip M. Hauser, assistant director of the Census Bureau

Class A-1 Areas

(Most rapid wartime growth plus best prospects of retention):

Corpus Christi, Tex.
Dallas, Tex.
Jackson, Miss.
Jacksonville, Fla.
San Antonio, Tex.
San Diego, Calif.

Class A-2 Areas

(Most rapid wartime growth plus superior chances of retention):

Charleston, S. C.
Columbia, S. C.
Columbus, Ga.
Mobile, Ala.
Washington, D.C.
Galveston, Tex.

Class A-3 Areas

(Above-average wartime growth plus excellent prospects of retention):

Atlanta, Ga.
Austin, Tex.
Beaumont-Port Arthur, Tex.
Chattanooga, Tenn.
Detroit, Mich.
Fort Worth, Tex.
Houston, Tex.
Kalamazoo, Mich.
Knoxville, Tenn.
Little Rock, Ark.
Los Angeles, Cal.
New Orleans, La.
Nashville, Tenn.
Sacramento, Cal.
San Francisco
Shreveport, La.

Class A-4 Areas

(Above-average wartime growth plus good prospects of retention):

Augusta, Ga.
Baltimore, Md.
Davenport-Rock Island-Moline (Ia. and Ill.)
Denver, Colo.
Evansville, Ind.
Indianapolis, Ind.
Macon, Ga.
Norfolk-Portsmouth-Newport News, Va.
Portland, Me.
Richmond, Va.
Salt Lake City
Savannah, Ga.
Seattle, Wash.
Tacoma, Wash.
Wilmington, Del.

Class A-5 Areas

(Above-average wartime growth plus fair prospects of retention):

Canton, Ohio
Chicago, Ill.
Cincinnati, Ohio
Columbus, Ohio
Decatur, Ill.
Fort Wayne, Ind.
Hamilton-Middletown, Ohio
Portland, Ore.
Pueblo, Colo.
St. Louis, Mo.
Springfield, Ohio

Class B-1 Areas

(Rapid wartime growth after rapid predepression growth; chances of retention dependent on ability to convert after the war):

Birmingham, Ala.
Dayton, Ohio
El Paso, Tex.
Hartford-New Britain, Conn.
Rockford, Ill.
Tulsa, Okla.
Wichita, Kans.

Class B-2 Areas

(Boom areas which may or may not be able to convert after the war):

Bridgeport, Conn.
Johnstown, Pa.
Louisville, Ky.
New Haven, Conn.
Akron, Ohio
Waco, Tex.

Class C-1 Areas

(Losing population or barely holding their own, but chances of "comeback" excellent):

Amarillo, Tex.
Asheville, N. C.
Binghamton, N. Y.
Charleston, W. Va.
Charlotte, N. C.
Lansing, Mich.
Oklahoma City, Okla.
Peoria, Ill.
Stockton, Calif.
Winston-Salem, N. C.
Miami, Fla.

Class C-2 Areas

(Only slightly lower in rank than Class C-1, above):

Durham, N. C.
Madison, Wis.
Memphis, Tenn.
Phoenix, Ariz.
San Jose, Calif.
Tampa-St. Petersburg, Fla.
Waterloo, Ia.

Class C-3 Areas

(Fair prospects of a "comeback"):

Cedar Rapids, Ia.
Des Moines, Ia.
Flint, Mich.
Fresno, Calif.
Huntington-Ashland (W. Va. and Ky.)
Minneapolis-St. Paul, Minn.
New York-Northeastern New Jersey
Roanoke, Va.
Spokane, Wash.
Springfield, Mo.
Topeka, Kans.
Youngstown, Ohio

Class D-1 Areas

(Losing population or growing very little; hard to evaluate):

Atlantic City, N. J.
Cleveland, Ohio
Grand Rapids, Mich.
Kansas City (Mo. and Kans.)
South Bend, Ind.

Class D-2 Areas

(Losing population or growing very little; little prospect of rapid postwar growth):

Allentown - Bethlehem-Easton, Pa.
Buffalo-Niagara, N. Y.
Erie, Pa.
Harrisburg, Pa.
Omaha-Council Bluffs (Neb. and Ia.)
Philadelphia, Pa.
Providence, R. I.
Springfield-Holyoke, Mass.
Terre Haute, Ind.
Trenton, N. J.
York, Pa.

Class D-3 Areas

(Losing population with little chance of recouping):

Albany - Schenectady-Troy, N. Y.
Altoona, Pa.
Boston, Mass.
Duluth-Superior (Minn. and Wis.)
Fall River-New Bedford, Mass.
Lancaster, Pa.
Lincoln, Neb.
Manchester, N. H.
Pittsburgh, Pa.
Racine-Kenosha, Wis.
Reading, Pa.
Rochester, N. Y.
Saginaw-Bay City, Mich.
St. Joseph, Mo.
Scranton - Wilkes-Barre, Pa.
Sioux City, Ia.
Springfield, Ill.
Syracuse, N. Y.
Toledo, Ohio
Utica-Rome, N. Y.
Wheeling, W. Va.
Worcester, Mass.

ployees of private enterprise, and w have the vision and wisdom to me their aspirations half way, gre benefits can redound to the publi service and to the tax-paying public he points out.

Bulwark of opposition to recogn tion of unions and collective bargai ing in the public service, continue Mr. Clapp, centers on two points (1) unionism is not permissible i public employment because employee cannot strike against the sovereignt of government; (2) collective bargaining with signed contracts cover ing wages, hours of work, etc., is no legal in the public service.

In answer to the first point, h says it should be clear that no manager of a municipal, state or federa agency confronted with a mass strik can be assured that the theory o governmental immunity, backed eve with the best legal counsel, will caus collapse of the strike. And, so far a legality of collective bargaining i concerned, this can be dismissed because there already exists many suc agreements.

Licensing of operators

Those concerned with developmen of personnel policies also may find i profitable to examine the extensio of licensing and certification of operators. Licensing has definite advantages for both employee and employer, and this form of regulatio has the endorsement of the America Water Works Association.

For the employee, the possessio of a license enhances his prestige creates added incentive in the performance of his duties and it minimizes political exploitation of his position. Aside from these benefits— which contribute so much to employee morale—operator licensing or certification provides a firm basis on which a municipality can rest its confidence and respect for the man charged with a vital public health responsibility.

State health agencies, of course, are the proper authority to conduct examinations and certify to the fitness of an operator. However, stimulation for the establishment of such regulatory control properly should originate with municipal officials, waterworks operators and others who desire improvement in water service administration.

Latest published information on the status of state licensing of opertors reveals that licenses are is- ued in eight states and certificates n thirteen. The action is voluntary n fifteen states, by authority of law n four, and by authority of state oard of health regulation in two.

The attitude of the American ater Works Association is expressed n a resolution adopted by the Board f Directors who, "realizing the importance of efficient operation of water purification plants as a protection to public health, endorses licensing, certification or some form of regulation of water purification plant operators and supervisors as a means of preventing the employment of incompetent personnel and assuring some continuity of employment of efficient personnel."

TREND OF TECHNICAL ADVANCES • • •

Earlier in this report it was rgued that there was little probaility that widely different materials nd equipment for waterworks serve would be immediately available ollowing the war. This assertion is ased in part on the fact that manuacturers have been devoting all their fforts to production. and little time r manpower has been available for ure development. Likewise, relaively little has been accomplished n the way of research pointing diectly to improvement of practice.

It may be true that in a few instances "by-product" results from war activities will have immediate postwar application to equipment and perhaps processing improvements. And in some cases new things were ready for use when war forced a halt to their promotion. All in all, however, this backlog of unannounced developments should bulk relatively small in its effect on new waterworks design or operation.

None of these comments are to be interpreted as disparaging or critical of those engaged in water service. They simply express what is believed to be a realistic—perhaps, conservative viewpoint—of the present status and future outlook. If this viewpoint is too conservative, it may be credited as being an antidote to the widespread and growing concept that the postwar period means revolutionary changes in practice.

No revolutionary changes

To support in part the conviction that changes will be evolutionary rather than revolutionary, you might put yourself in the position of a waterworks manufacturer. His thinking and his activity quite properly reflect the fact that the replacement market represents an important part of his business. Therefore, he must approach with caution the introduction of revolutionary changes in equipment because some of this must be adapted for use in plants already built and simply in need of renovation. This matter of adaptation for replacement is an important factor in equipment design.

Furthermore, manufacturers must be cautious when it comes to making radical changes because they cannot financially justify complete new patterns or retooling since their volume of production on each item is relatively small and production costs must be spread over a long period. In this respect, the manufacturer of equipment for waterworks—the volume per item of which is relatively small—is in quite a different position from one engaged in mass production manufacturing, such as the maker of automobiles.

Activity of manufacturers

To determine specifically what waterworks manufacturers are thinking and doing about the postwar period, *Engineering News-Record* made a canvass of firms representing a cross-section of the field.

The returns from this survey eloquently testify to the validity of the following viewpoints:

1. War production has claimed and is receiving first attention; as a result:
2. Planning for postwar activity has been negligible thus far, but practical efforts in this direction are being considered. However, it is generally agreed that:
3. No radical changes are anticipated in the design of present products, nor will there be much possibility of revolutionary changes. By and large, the most that should be expected is that:
4. Minor improvements will result from refinements of design and better production facilities and these will be reflected in equipment that is easier to operate, simpler to maintain and will cost less. Beyond this it is true that:
5. Research and development programs are being drafted, but war production demands make it impossible to further such activity now. In this connection:
6. Definite project plans resulting from the efforts of individual municipalities will contribute materially in aiding manufacturers to prepare themselves for the part they will be called upon to play in postwar work.

Excerpts from some of the letters received from manufacturers are most illuminating, and they give added emphasis to the general statements made above. These comments are grouped on adjoining pages.

Of immediate interest to manufacturers should be the suggestions made by the Postwar Activities Committee of the New England Water Works Association. Composed of operators and consulting engineers, the committee's viewpoint is one that should carry much weight with producers of supplies and equipment. In part, the committee outlines this program for manufacturers:

Expenditure for carefully planned research should be increased, and new designs, materials and equipment should be investigated.

The possible use of materials such as plastics and laminated wood should be canvassed.

Chemical companies and manufacturers of construction materials should be educated as to the special requirements of the waterworks field, and encouraged to provide better and more useful products.

Exhaustive tests on new developments should be carried out so that the inevitable difficulties therewith may be discovered and corrected before such developments are offered to the waterworks superintendent or engineer.

Some desirable research

Halting of research and development and the need to resume such activities as soon as this becomes opportune, constitutes another part of postwar planning. There are, in fact, many technical questions in water service, the answers to which call for expanded programs of research that might well be initiated now.

Some suggested avenues of re-

(Continued on page 144)

Postwar Waterworks Equipment

THE MANUFACTURERS' VIEWPOINT

● Municipalities and consulting engineers who may now be considering design or rehabilitation of waterworks are vitally interested in knowing what they might anticipate in the way of new or improved equipment or processing when the war ends. Contrary to prevalent curbstone opinions, manufacturers are not planning the introduction of devices that will depart widely from those now available. The following typical comments of manufacturers should be reassuring to municipalities who have been hesitating over the desirability of advance engineering.

Equipment Co.—At present we do not have any new processes or equipment in mind that will revolutionize present practice, but we have several things under consideration for development that may be a definite contribution toward lower operating costs. However, whether time, priorities and manpower will make this development possible in the near future is questionable. Improvements probably will be made in (a) better designs based on field studies; (b) revamping of details to reduce manufacturing and installation costs; and (c) standardization of designs to reduce engineering costs.

Chemical Equipment Co.—While we hope to have numerous improvements in our various types of equipment, we see nothing that would indicate any reason to delay the planning of projects on the ground that these plans will be obsolete after the war. Obviously, the length of the war and the manpower available for development work will dictate the number of improvements made.

Accessory Equipment Co.—While we expect to have new items on the market after the war, we will doubtless have to continue our present line for several months until we have had the opportunity of making thorough tests and satisfying ourselves that the new goods are required. At present, our engineers are engaged in war production and do not have the time to give thought to new things.

Steel Pipe Co.—There are no startling new developments in the manufacture or use of welded plate pipe for water service. Steel pipe with special cold tar base linings and coatings had been well developed before the war. The American Water Works Association specifications for this product are coming into more general use, and further standardization of the details and desig are about the extent of anything new.

Measuring Equipment Co.—We anticipate that the postwar period municipalities will endeavor to catc up on deferred and very necessary improvements an will keep us busy for many months to come. We do n anticipate any revolutionary changes in metering method but it can be said that instruments and controls hav been continuously improved.

Recording Instrument Co.—In view of the fact tha the problems of the waterworks engineer will, no doub be about the same after the war as they have been fo many years, there will probably be no revolutionar changes made in the type of instruments he will need In the postwar period we see a wider use of telemeterin equipment. The problem solved by use of instrument for this purpose is a basic one and for this reason ther should be nothing revolutionary.

Meter Instrument Co.—As a result of war experience in endeavoring to keep existing equipment operating we have become maintenance conscious to a far greate extent than ever before. This will be reflected in our postwar products by the introduction of minor changes which will greatly facilitate maintenance. Likewise lessons in mass production through manufacturing of war items will be applied to waterworks equipment in order that it can be sold at a lower price.

Pump Co.—We anticipate no radical changes in the design or performance of our equipment which, in each case, is built special in accordance with service requirements as called for in the customer's specifications.

Meter Co.—We do not have any products planned that will "revolutionize present practice" in the waterworks field. At present we are emphasizing both through our sales force and in our advertising the necessity for water departments to plan to absorb their share of returning men from the armed forces and from war industries by improving their methods of handling meter repairs and maintenance.

Control Meter Co.—Basic designs of metering equipment for waters supply and sewage treatment have not changed during the period in which we have been at war. Certain new improvements are now in the development stage, which will simplify meter layout and improve the accuracy of measurement, especially where indicating and recording equipment is located at a distance from the point of measurement.

Pipe Co.—In connection with the production of cas on pipe, fittings and special castings for the furtherance the war effort, improvements have been made in our nufacturing processes. These improvements in connection with the new A.S.A. law of design for cast iron pe and fittings will place us in a position to meet the ost exacting requirements in the waterworks field.

Pipe Co.—Generous credit must be given to the effec e work that has been done by the American Water orks Association Subcommittee 7A, particularly in the velopment of standard specifications for steel pipe and otective coatings 7A-3, 7A-4, 7A-5 and 7A-6. The ailability and acceptance of these standards will be ghly beneficial for postwar work.

Valve Co.—At the moment we are unable to forecast e precise effect of our research. At most, however, it ight broaden our line, but it will certainly not change e design of the basic gate valves.

Excavator Equipment Co.—We do not anticipate ything radically different in the design or action of enchers. There will, of course, be improved materials at will provide for faster digging and traveling speed.

Construction Machinery Co.—We are planning neral improvement of our regular line of manufacture. o radical changes— just a thorough revamping to the oint of a better product for greater operating efficiency us low maintenance cost.

Pump Co.—Based on events immediately prior to d during this war period, we do not anticipate any dical changes in pump design and construction but ther a refinement of principles and application. It is cognized that the waterworks field will represent a nice gment of the postwar market due to obsolescence of esent equipment, the increased demand due to shifted pulations, and the natural trend toward more efficient uipment. It is conceivable that basic material changes ight occur that would greatly alter both design and nstruction, but it is questionable as to how quickly ch changes could be effected even if the war should d tomorrow.

Pipe Co.—Much has been written about industry pro ding employment, but from a practical point of view, dustry can do this only when a demand is created for goods. Such a demand may be natural, or it may be ought about by postwar planning, almost all of which ll have to be of a public works character. Such work ll provide an excellent and perfectly legitimate method cushioning what could conceivably be a postwar nemployment chaos.

Meter Accessory Co.—No revolutionary changes are ticipated, although we do have two or three improved tings that can be made available as soon as restrictions e off on the use of brass and copper. We are thinking out some experimental work but we have been too sy making war materials to get at it. So far as water rks practice is concerned we do not feel that the world ll be a lot different after the war. There will be gradual provements, of course, but probably not much faster an they have been coming during the past twenty years.

Steel Tank Co.—We will be able to offer designs and structures that will embody new structural design features and more pleasing appearance. Certain war developments also have made feasible a new type of pressure storage where the gravity tank may be objectionable. Neither of these ideas offers anything revolutionary as gravity and pressure storage are basic principles that have been well established for many decades. In our opinion, postwar planning for the improvement of municipal and public facilities should be sponsored throughout the country. Only a definite plan that is made by the individual municipality for postwar improvement will accomplish the final result in which all of us are interested. Those projects on which the plans and specifications are all ready, awaiting bids, are the ones that will do the most good for all.

Tank and Pipe Co.—Based on previous experience, we no doubt will continue to design elevated storage tanks that are pleasing in appearance and have a low range in head. There probably will be no radical change in design or construction practice, however. Use of steel pipe for high pressure lines of large diameter probably will be more pronounced than before the war. Research on the application of pipe coatings will continue and experience records of installations made just previous to 1942 should enable the manufacturers of steel pipe to produce satisfactory coatings efficiently and economically.

Control Apparatus Co.—Discoveries made under the pressure of demands have helped us cut many corners and improve designs to such an extent that our equipment will be more efficient and reflect savings passed along to customers.

Well Co.—We are so swamped with work and red tape that we cannot give any time to postwar conditions.

Meter Co.—Large meters have been in great demand for cantonments, public housing projects and factories, many of which will not be required after the war. The manufacture of large water meters will, therefore, be impeded until old meters are salvaged and placed in new construction. On the other hand, small meter production has been greatly restricted, and repair and maintenance have been postponed so that domestic meters are incurring accelerated deterioration. Replacement of the small, worn-out meters, combined with a residential building boom, will assure a market for domestic meters.

Pump Co.—This period, during which repairs rather than replacements have been the order of the day, has clearly developed postwar needs for new equipment to replace existing units which have been kept in service long after they would normally have been considered obsolete. The reliability and high economy of the heavy-duty diesel engine has been fully proven as a driver for waterworks pumping units carrying the base load. The inherent advantages of this type of driver should be considered along with steam turbines and electric motors in all comparative preliminary studies. Changes in design of centrifugal waterworks pumps during the war has not been radical. Therefore, municipalities receiving recommendations at the present time may feel assured that they will cover the designs and practice which will still be current when the war ends.

search are indicated in the following:

Corrosion—Is oxygen or carbon dioxide or bacteria (internal and external) the cause of corrosion? What is the role of inhibitors and what new scientific information can be developed relating to their use?

Groundwater—How are geologic formations related to quantity and quality of water?

Health—What is the effect of soluble decomposition products on the physiology of man? Are there certain irritants and stimulants (in connection with internal disorders) that result from the use of sewage-polluted water? Does the action of water on materials used in the conveyance and distribution of water have any significance on health?

Sedimentation—Is it possible that further investigation of physical, chemical and other scientific laws will provide a better understanding of sedimentation phenomena that will lead to improvement of settling basin design and operation? What improvement can be made in flocculation practice that will be reflected in higher efficiency of sedimentation?

Filtration—What are the possibilities of improving filtration practice? For example, cleaning of filter sand with backwashing is inefficient in that it requires the use of much water—therefore, does the use of air wash or other means of washing call for exploration? Perhaps bold and venturesome research might evolve entirely new principles of filtration.

Raw Water Processing—It was once the philosophy that the filter was the most important unit in water treatment but today it is recognized that pre-treatment is one of the most important elements. Therefore, research on flocculation, methods of pretreatment and sedimentation, may be the key to higher efficiencies in filtration.

Selective Adsorption — Organic base change materials promise wide applications in water treatment. And certain dyes have been found to have selective killing action on bacteria; perhaps this may offer a clue for a program of research on poliomyolitis control.

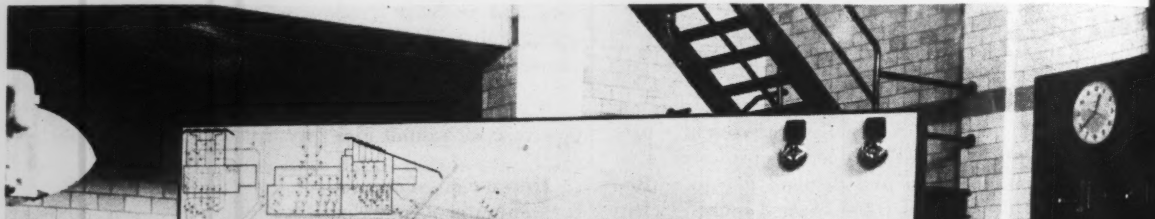
Industrial Wastes—What is the action of chemical waste pollution regard to the improvement or di culties in the operation of a wa treatment plant?

This brief listing is not intend to indicate the scope of problems th call for attention, but it does su gest a variety and diversity of ch lenging research activity.

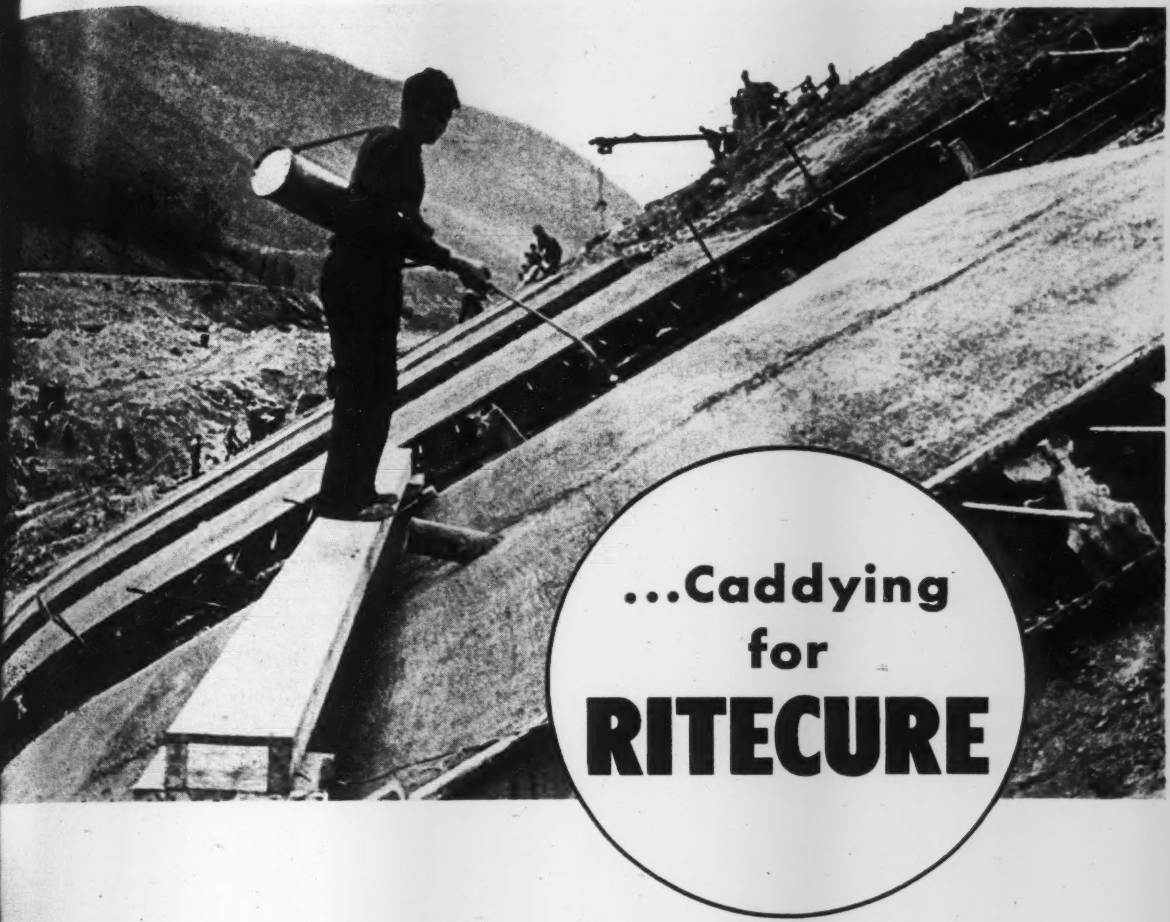
By way of conclusion

As stated in the beginning of th report, postwar planning is a coll tive enterprise with individual sponsibilities. However, the speci role to be played by any individual- municipal, administrator, engine contractor or manufacturer—cann be defined until common objectiv are established. This discussion h been directed toward an explorati of objectives, the realization of whi are of common concern and whi point to more effective water servi

The helpful participation and i spiration of all those whose couns was solicited in the preparation this report are acknowledged wi appreciation by *Engineering New Record* and the writer.



On the program for postwar modernization of many waterworks plants is the installation of supervisory and automatic control systems. The control station pictured above is at one of the Minneapolis water department's pumping stations.



..the "champion" curing compound

MANY a workman, like the one in this picture, has toted the portable RITECURE Spray ank to film-cure the concrete on the country's nportant jobs: on dams, airports, bridge approaches, roads, landing strips, foundations, floorg, sidewalks, pipe, igloos.

hat is it that puts RITECURE in the championhip class?

Briefly, it does the best work, as proved both by tests and on jobs. It has the highest percentage of solids, which form the curing film. It covers between 30 to 40 yards per gallon. It helps to harden the surface of the concrete. It retains better than 90% of the moisture through the 28 day curing period.

Using RITECURE is sound insurance. It means finishing up a carefully poured job with proper curing.

RITECURE

A Transparent Membrane for Curing Concrete

IS SOLD BY:

THOMPSON MATERIALS CORP.

204 WEST STREET, NEW YORK, N.Y.

a product of: **The Johnson-March Corporation, 52 Vanderbilt Avenue, New York, N. Y.**

RITECURE
The
TRANSPARENT
CURE

PRODUCT OF
THE
JOHNSON-MARCH
CORPORATION
52 VANDERBILT AVENUE
NEW YORK, N.Y.

6-JM-6

CONTRACT UNIT PRICES

What contractors are bidding on different kinds of construction work

OVERHEAD BRIDGE APPROACHES WEST VIRGINIA

OWNER: West Virginia State Road Commission, Charleston.

PROJECT: Grading, draining, gravel base and concrete pavement (8-in.), in connection with construction of approaches to bridge across tracks of New York Central Railroad and Campbell Creek Railroad in Reed, Kanawha County, W. Va. Length of project is 0.451 miles.

CONDITIONS: All excavation must be hauled over detour provided by contractor, crossing tracks of N.Y.C. RR. and the Campbell Creek RR., and around operations of bridge contractor constructing the Reed overhead crossing. Contractor to furnish all materials and complete work in 175 working days. Rail and highway transportation facilities available. Minimum wage rates specified are: skilled labor, 80c. to $1.35 per hour; semi-skilled, 65 to 70c.; and common labor, 60c.

LIST OF BIDDERS: (Bids opened April 13, 1943.)

1. Smith Constr. Co., Huntington, W. Va. (contract)	$239,606
2. Price Constr. Co., Huntington, W. Va	268,307
3 Gorman Constr Co., Fleminsburg, Ky	280,539
4. T. C. Staples Constr. Co., Charleston, W. Va	294,276

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Clearing right-of-way	3,490 l. f.	$0.20	$0.10	$0.50
2. Unclassified excavation	152,200 c. y.	.74	.80	.88
3. Overhaul	1,500,000 sta. y.	.01	.005	.01
4. Structure excavation	4,200 c. y.	2.00	2.50	1.75
5. 6-in. gravel sub-base	2,500 c. y.	2.00	2.00	3.00
6. 2- to 4-in. courses, macadam base	175 c. y.	5.00	7.00	7.00
7. Asphaltic concrete — surface course	45 ton	12.00	20.00	15.00
8. 8-in. concrete pavement	13,850 s. y.	3.00	4.00	3.25
9. ½-in. longitudinal joint	700 l. f.	.15	.15	.15
10. ¾-in. transverse expansion joint	1,150 l. f.	.20	.20	.17
11. 15-in. plain concrete pipe	410 l. f.	2.00	2.00	2.50
12. 18-in. plain concrete pipe	750 l. f.	2.50	2.50	3.50
13. 24-in. plain concrete pipe	400 l. f.	4.00	4.00	4.50
14. 8-in. perforated concrete pipe	500 l. f.	1.00	1.00	.75
15. Broken stone for underdrain	125 c. y.	5.00	3.50	3.00
16. Class B concrete	650 c. y.	17.00	25.00	22.00
17. Stone masonry	1,850 c. y.	14.00	15.00	17.00
18. Tie bars	2,700 lb.	.10	.10	.15
19. Drop inlet castings, precast	2 ea.	30.00	50.00	50.00
20. Sidewalk inlets	5 ea.	100.00	75.00	100.00
21. Median strip drop inlets	6 ea.	100.00	75.00	100.00
22. Concrete integral curb	2,675 l. f.	.80	1.00	.80
23. Plain concrete curb	4,200 l. f.	.80	1.30	.65
24. Concrete sidewalks	11,000 s. f.	.35	.30	.32
25. Guard rail posts	250 ea.	1.00	1.00	2.50
26. Grouted stone gutter	45 s. y.	4.00	5.00	5.00
27. Water for maintaining traffic	1,000 M gal.	1.00	3.00	5.00

CONCRETE ARCH BRIDGE, INDIANA

OWNER: Indiana State Highway Commission, Indianapolis.

PROJECT: Construction of reinforced concrete arch bridge 320-ft. long over Blue River, near Edinburg, Johnson County, Ind. Bridge is four-span structure, each span 80-ft. long. Roadway width 28-ft. with walks. Work included also involves ditch paving, traffic lane stripes, and barricades.

CONDITIONS: Contractor to furnish all materials and complete work in 150 days. Rail and highway transportation facilities available. Minimum wages specified are: skilled labor, $1.00 per hour; semi-skilled, 75c.; and common, 55c.

LIST OF BIDDERS: (Bids received April 20, 1943.)

1. Smith & Johnson, Indianapolis, Ind. (contract)	$102,392
2. Curry Constr. Co., Bloomington, Ind	105,880
3. Sweet Bros. & Co., Woodburn, Ind	120,528
4. Mulzer Constr. Co., Martinsville, Ind	121,195
5. Cradle Bros., Inc., Carmel, Ind	127,832
6. R. L. Schutt, Indianapolis, Ind	131,625
7. R. P. Olinger, Huntingburg, Ind	147,489

Item	Quan.	Unit Prices (1)	(2)
1. Class D concrete	779.6 c. y.	$30.00	$24.00
2. Class E conc. above footings	772.0 c. y.	25.00	24.00
3. Class E conc. in footings	739.5 c. y.	16.00	24.00
4. Handrail	850 l. f.	4.20	4.50
5. Wet excavation	1,925 c. y.	4.80	5.00
6. Dry excavation	1,120 c. y.	.60	1.00
7. Waterway excavation	6,800 c. y.	.70	.50
8. Common excavation	445 c. y.	.90	.50
9. Special borrow	3,160 c. y.	.70	.50
10. Special filling material	6,850 c. y.	.10	.70
11. Furnish equipment for driving piles	Lump Sum	100.00	150.00
12. Timber piles driven	9,600 l. f.	.30	.30
13. Timber piles furnished	12,000 l. f.	.50	.50
14. Reinforcing steel	186,906 lb.	.06	.055
15. Rein. concrete pavement, plain	1,967 s. y.	2.60	2.30
16. Pavement expansion joints	44 l. f.	.50	.80
17. Waterproofing	2,085 s. y.	.40	.30
18. Sodding	1,020 s. y.	.30	.30
19. Special seeding	0.5 ac.	200.00	100.00
20. Spec. pavement contraction joints	704 l. f.	.30	.50
21. Guide posts, Type A	24 ea.	3.00	2.50
22. Integral curb-walk	6 s. y.	5.00	6.00
23. Paved side ditch	176 l. f.	1.50	1.25
24. Special 3-ft. paved ditch	110 l. f.	3.00	2.00
25. 4-in. traffic lane stripe	0.293 mi.	300.00	500.00
26. ½-in. preformed bitum. expan. joints	1,135 l. f.	.30	.30
27. Standard barricades	2 ea.	50.00	50.00

HIGHWAY, WYOMING

OWNER: Wyoming Highway Dept., Cheyenne.

PROJECT: Grading, drainage, base course surfacing, oil tr ment by road-mix method, stone chip seal coat, and constr tion of one treated timber bridge with eight 23-ft. spans Rock Springs Airport Road, Rock Springs, Wyo. Total len of project is 3.683 miles.

CONDITIONS: Contractor to furnish all material exc treated timber and 875 lb. of hardware. The above is to obtained from existing but abandoned bridges. Contractor dismantle bridges and haul necessary material to bridge s Average haul is 85 miles. Rail and highway transportat facilities available to site of work. Completion time: 1 working days commencing 20 days after notice of awa Minimum rates are: skilled labor, 85c. to $1.20 per hou semi-skilled, 70c.; and common, 65c.

LIST OF BIDDERS: (Bids received March 11, 1943.)

1. Wyoming Constr. Co., Laramie, Wyo. (contract)	$99
2. H. W. Read, Cheyenne, Wyo	100
3. Northwestern Engineering Co., Rapid City, S. D	109
4. C. C. Warrington, Cheyenne, Wyo	115
5. Leach Brothers, Cheyenne, Wyo	117
6. Inland Constr. Co., Omaha, Nebr	117

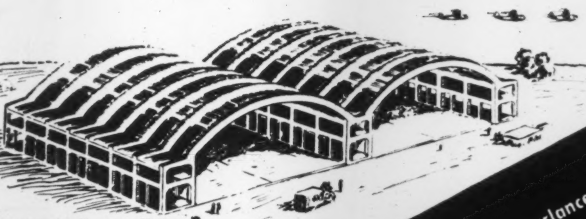
Item	Quan.	Unit Prices (1)	(2)
1. Excavation	162,000 c. y.	$0.18	$0.19
2. Overhaul	20,000 c. y. sta.	.015	.015
3. Cubic yard mile haul	19,500 c. y. mi.	.20	.15
4. Watering (embankment)	1,660 M. gal.	2.50	3.00
5. Sheepsfoot roller operation	960 hr.	3.50	3.00
6. Pneumatic-tired roller operation	30 hr.	5.00	3.50
7. Excavation for pipe culverts	50 c. y.	1.50	1.50
8. 18-in. vitrified clay pipe	558 l. f.	2.50	2.60
9. Mechanical tamping	80 hr.	3.00	2.60
10. Class I riprap	120 c. y.	6.00	4.00
11. Grouted riprap	40 c. y.	10.00	8.00
12. Timber project markers	2 ea.	20.00	10.00
13. Pit run gravel base crse. (3-in. max.)	17,800 ton	.825	.90
14. Crushed gravel base crse. (1-in. max.)	3,950 ton	1.13	1.19
15. Crushed gravel surfacing (¾-in. max.)	4,600 ton	1.13	1.19
16. Stone chips	445 ton	4.00	2.85
17. Base treatment, MC-1	150 ton	22.05	24.30
18. Seal coat, RC-3	77 ton	22.05	25.40
19. MC liquid asphalt distributed (MC-3)	300 ton	22.05	25.00
20. Processing roadway	45,400 s. y.	.06	.045
21. Watering (base)	350 M gal.	2.50	3.00
22. Roller operation (base)	220 hr.	5.00	2.70
23. Shaping and tamping curb	2,800 l. f.	.10	.05
24. Shaping and tamping spillway	80 l. f.	.30	2.05
25. Structure excavation	100 c. y.	2.00	1.00
26. New treated timber	26.041 M bm.	174.00	185.00
27. Salvaged treated timber	29.148 M bm.	53.30	50.00
28. Treated timber piling	1,666 l. f.	1.66	1.75
29. Untreated timber	1.650 M bm	150.00	165.00
30. Remove four timber bridges	Lump Sum	3,000.00	1,800.00
31. Patrol hours	50 hr.	9.00	5.30

In Flying Parlance—A Cross-section Rendering of

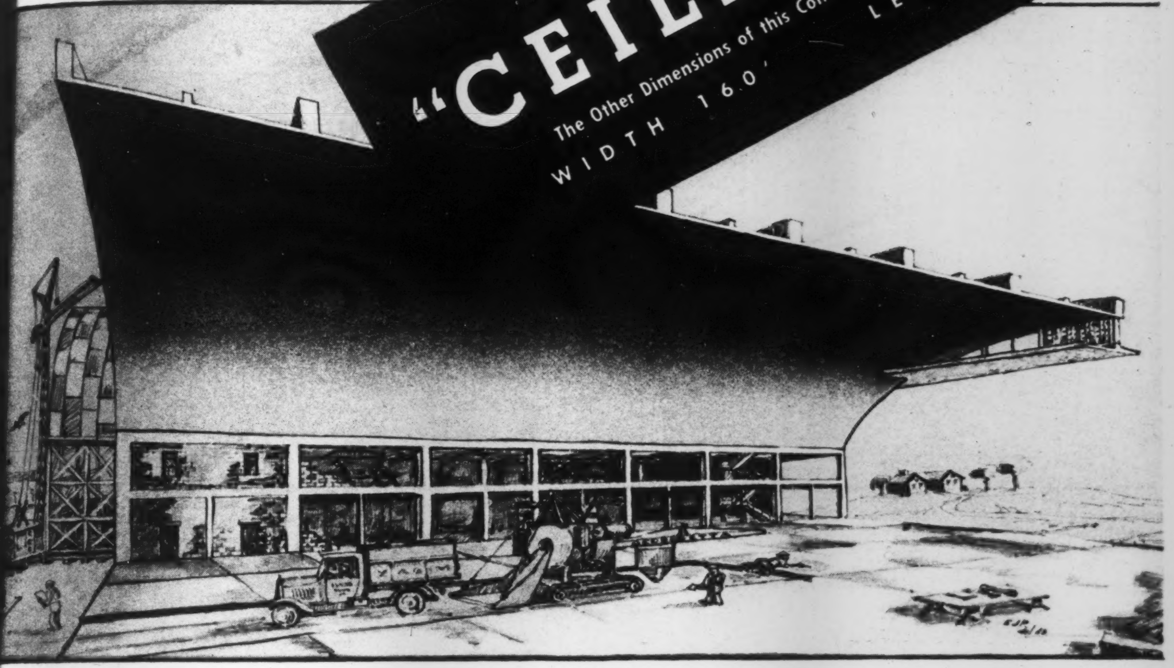
"CEILING 55'"

The Other Dimensions of this Concrete Arched-Roof Span Being

WIDTH 160' LENGTH 250'



strating one of the six Hangar Units der Corbetta construction for the S. Navy. Location of site withheld.



Roosts for Warbirds

Clear, unobstructed, concrete floor slabs. New, more economical, most practical type of concrete arched roof spans . . . complete with full length, concrete, two-story lean-to facilities at both ends and through the center. Each double-spanned unit puts to efficient operational use every inch of its 103,250 sq. ft. of ground area.

At one site—and widely spaced apart—a series of six of these Twin-span Hangar Units is now under Corbetta-construction. Undertaken in concrete at less cost than similar structures of wood or steel, this project has already progressed far enough—and fast enough—to establish proof to its claims of economy and speed of erection. Once "commissioned", the record will also include minimum maintenance cost.

Again we might say, this is another example of Corbetta ability to see things through—and get things done!

CCC

CORBETTA CONSTRUCTION COMPANY, INC.

FOUNDED UPON "GETTING THINGS DONE"

EXECUTIVE OFFICE: 220 EAST 42nd STREET, NEW YORK, N. Y.

AHOMA • NEBRASKA • WEST VIRGINIA • PENNSYLVANIA • OHIO • MARYLAND • DELAWARE • NEW JERSEY

MATERIALS AND LABOR PRICES

Market quotations on construction materials and wage rates reported monthly by ENR correspondents

JUNE CONSTRUCTION material prices reveal only minor changes from the preceding month. Revised ceiling prices on 1-in. boards has had the effect of increasing short leaf yellow pine prices by $1.00 per M ft. in Atlanta and St. Louis; by $2.00 in Dallas; and by $2.00 to $3.00 in Baltimore. Two-inch pine boards, on the other hand, were $1.00 lower in Atlanta and Dallas. Douglas fir 2-in. boards are $1.00 to $3.00 higher in Kansas City. Fir timber is $2.00 lower in Baltimore, but up $2.00 in St. Louis.

Wrought steel pipe discounts increased May 15 due to the suspension of the 6 percent freight rate for the trial period from May to December, 1943. Kansas City, Minneapolis, New York, Philadelphia and San Franci reported changes this month.

Iron and steel products were unchanged except for minor changes Kansas City and Philadelphia. Roofing supplies, paint, structural c building tile, common brick, paving brick, lime and asphalt pro remained at May price levels.

Construction labor rates for both skilled and common workers w steady, with no changes reported in any of the *ENR* cities from the prec ing month's wage levels.

CEMENT, AGGREGATES, READY-MIXED CONCRETE—F. O. B. CITY

	PORTLAND CEMENT Per bbl., carload lots, including 40c. per bbl. for bags, cash discount not deducted			SAND AND GRAVEL Per ton, carload lots			CRUSHED STONE Per ton, carload lots		CRUSHED SLAG Per ton, carload lots, f.o.b. plant		CONCRE Ready Mi 1:2:4, 50 c. more, deliv
	Cloth Bags *a*	Paper Bags	Bulk	Gravel, 1½ in.	Gravel ¾ in.	Sand	1½ in.	¾ in.	1½ in.	¾ in.	
Atlanta	$2.77	$2.52	$2.47	$1.79	$1.89	$1.99	$1.79	$1.89	$1.59	$1.69	$8.00
Baltimore	2.33	2.08	1.88	1.75‡	1.75‡	1.25‡	1.75‡	1.75‡	1.75‡	1.75‡	7.25
Birmingham	2.50	2.25	2.10	1.75	1.75	1.50	.85	1.00	.90	1.15	5.80
Boston	2.75*b*	2.40*b*	2.30	1.40‡	1.40‡	1.00‡	1.40‡	1.40‡	....	....	7.25
Chicago	2.70	2.45	2.30	2.15‡*d*	2.15‡*d*	2.15‡*d*	2.15‡*d*	2.15‡*d*	1.75‡	1.75‡	....
Cincinnati	2.31	2.06	1.81	1.20	1.20	1.10	1.80	1.80	....	....	6.60
Cleveland	2.40	2.15	....	1.70*i*	1.70*i*	1.60*i*	1.70*i*	1.70*i*	1.75*i*	1.75*i*	7.30
Dallas	2.52	2.27	2.07	1.50*p*	1.70*p*	1.10*p*	1.69*p*	1.79*p*	....	....	6.20
Denver	3.08	2.88	2.68	1.20	1.40	1.25	1.65	1.75	1.00	1.00	7.25
Detroit	2.39	2.14	1.99	1.65	1.65	1.20	1.63	2.00	2.40‡	2.45‡	6.50
Kansas City	2.58	2.33	2.18	1.85	2.30	1.00	1.91	1.91	....	....	7.50
Los Angeles	2.80*v*	2.20*v*	....	1.30	1.30	1.15	1.30*f*	1.30*f*	....	....	7.25
Minneapolis	2.90	2.65	....	1.00*h*	1.00*h*	.25*h*	1.00*h*	1.00*h*	....	....	7.10
Montreal	....	1.95*rs*	1.79*rs*	....	....	1.30‡*t*	1.05‡*ct*	1.15‡*ct*	....	....	7.90
New Orleans	2.41	2.16	1.96	1.65	1.65	.90	....	....	....	....	9.25
New York	2.66‡	2.41‡	....	1.60*de*	1.60*de*	.90*de*	1.70*de*	1.80*de*	....	....	7.50*k*
Philadelphia	2.33	2.08	1.88	1.55‡	1.65‡	1.20‡	1.90	1.95	1.10	1.10	8.20
Pittsburgh	2.44	2.19	1.99	1.40‡	1.40‡	1.70‡	2.25‡	2.25‡	1.50	1.50	8.25
St. Louis	2.80	2.52	....	1.75‡	1.50‡	1.25/1.50‡	1.10*h*	1.10*h*	.75*gw*	.75*gw*	8.00
San Francisco	....*u*	2.22	1.92	1.36	1.36	1.36	1.46	1.46	....		7.55
Seattle	2.95*o*	2.75*o*	....	1.00*o*	1.00*o*	1.00*o*	2.00*o*	2.00*o*	..	....	7.25

‡ Delivered. *a* 10c. allowed for each returnable bag. *b* 10c. per bbl. off for cash. *c* Plus municipal tax. *d* Per cu. yd. *e* Barge lots alongside docks. *f* Crushed granite. *g* F.o.b. Granite City, Ill. *h* F.o.b. plant. *i* Within three miles of Public Square. *j* 5% discount for cash. *k* Discount of 2 percent for cash in 10 days. *l* Up to 200 cu.yd. *m* 50c. off for cash. *n* 25 c.y. or m *o* 2% off for cash. *p* 10c. per ton off, cash 15 days. *r* 10c. per bbl. off, cash 20 d *s* 8% sales tax included. *t* 8% sales tax not included. *u* Price withdr *v* 20c. per bbl. discount; 20c. allowed for returnable cloth bag. *w* No marke

CASH DISCOUNTS CEMENT to Contractors: truck delivery, 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash disco 10c. per bbl. for payment within 15 days of date of invoice. Subject discount 10c. per bbl. 20 days in Montreal.

CURRENT MAXIMUM PRICES RECEIVED AT CEMENT MILL

Charge for bags not included. For cloth bags, add 40c. per bbl.; 10c. refund allowed for each returnable bag; for paper bags add 15c. per bbl., not refunda

	Bagged	Bulk
Buffington, Ind.	$1.70	$1.65
Dallas, Tex. (Inc. 10c. tax)	1.85	1.80
Hannibal, Mo.	1.70	1.65
Hudson, N. Y.	1.75	1.70
Independence, Kans.	1.70	1.65
Ironton, Ohio	$1.60	$1.55
Limedale, Ind.	1.70	1.65
Norfolk, Va.	1.75	1.70
Northampton, Pa.	1.55	1.50
North Birmingham, Ala.	1.70	1.65
Richard City, Tenn.	$1.80	
Steelton, Minn.	1.80	
Universal, Pa.	1.65	
Waco, Tex. (Plus 9c. tax in Tex.)	1.75	
Montreal (8% sales tax incl.)	1.68	

Discount 10c per bbl. 20 days

PAVING BRICK, BLOCKS, ASPHALT, ROAD OILS—F. O. B. CITY

	PAVING BRICKS AND BLOCKS			PAVING ASPHALT Per ton, less than 80 penetration		ASPHALT BINDERS—FLUXES Per gal., 80–300 penetration		CUTBACK ASPHALT Per ton		ROAD OILS Per gal.	ASPHALT EMULSION (Quick-breaking) Per gal.
	Granite per M. lots of 50,000 4x4x8 in.	Brick per M. 3x4x8½ in. carload lots	Wood per sq. yd. 3½ in. 16-lb. treat	Tank car	Drums	Tank car	Drums	Tank car	Drums	Tank car	Tank car
Atlanta	$73.00	$39.35	$2.25	$18.40*e*	$24.62*e*	$0.0787*e*	$0.1309*e*	$0.0876*he*	$0.1348*h*	$0.0676*e*	$0.0826
Baltimore	150.00‡	48.00	80.00*m*	15.00*r*	21.00*r*	.06*r*	.09*r*	13.00*r*	23.00*r*	.065*r*	07*r*
Birmingham	......	32.00*j*	.....	17.95	.....†	.0747	.....†	.0834*h*	.....†	.065	.09
Boston	80.00	55.00	3.75	14.20	20.00	06	.09	.065*h*	.115*h*	.065	.09‡
Chicago	150.00	55.00	1.80/2.00*d*	14.00	22.50	13.00*g*	21.50*g*	.0575*h*	.15*h*	.05*n*	.09/.10*n*
Cincinnati	112.00	37.00	.....	16.40	.....	.085	.....	12.25	.....	.07	.085
Cleveland	118.00	37.50	2.25	19.00	23.50	.10	.11	.09*h*	.105	.10	.10
Dallas	.....	36.00	.....	13.65	20.30	.06	.11	16.00	24.80	.06	.05/.07
Denver	.....	27.50	.....	.....	.....	.....	.....	.....	.....	.....	.....
Detroit	.....	37.50	.....	18.06*f*	25.60*f*	.0743	.128	.0718*h*	.119*h*	067	.0755
Kansas City	.....	40.00	.....	18.50	23.50	.077	.1075	.077*h*	.107*h*	.057	.11
Los Angeles	.....	50.00	.....	9.00*b*	23.00	9.50*bg*	24.00*bg*	9.50*b*	.....	.025	.072
Minneapolis	.....	.....	2.30*d*	.....	27.70	.....	.126	.....	32.64	.....	.....
Montreal	.....	.....	.....	16.60*k*	24.25*k*	.116*k*	.1485*k*	.115*hk*	.135*hk*	.08*k*	.135*k*
New Orleans	.....	.....	.....	13.50*a*	20.00*a*	.057	.088	.06*h*	.095*h*	.....	.080
New York	.....	70.00	.....	17.40	24.20*p*	14.00	.....	.0725*h*	.1325*hp*	.....	.0725*p*
Philadelphia	130.00	58.00	4.06	15.00	.....	14.00	.....	.065*h*	.....	.....	14.00*g*
Pittsburgh	135.00	38.75	.....	.....	.....	.....	.....	.....	.....	.....	.....
St. Louis	......	37.00	.....	16.00	22.00	15.00*g*	21.00*g*	.0575*h*	.1213*h*	.648	.0705
San Francisco	......	70.00	.....	9.50	18.75	9.50*gr*	18.00*gr*	10.00	17.50*r*	9.50*g*	.0525
Seattle	......	60.00*c*	.....	10.90*i*	19.40*i*	.....	20.40*gi*	11.40*i*	.....	10.90*i*	.0525*i*

‡ Delivered. *a* F.o.b. Baton Rouge. *b* Delivered to purchaser's warehouse. *c* 3½x4x8½ in. *d* 2½ in. 12-lb. treatment. *e* Local reduction due to 20% reduction intra-state class freight rates, only Georgia affected. *f* Mexican. *g* Per ton. *h* Per gallon. *i* F.o.b. Martinez. *j* 3x3½x8½ in. *k* Tax included. thousand. † Available on priority only and quoted specially. *p* No steel dru shipments except to armed forces. *r* February 1943 prices, none later availa

IRON AND STEEL PRODUCTS—BASE MILL PRICES

	STRUCT. SHAPES-PLATE	REINF. BARS ¾-in billet *b*	RIVETS ½-in. structural	WIRE NAILS Base *d*	SHEET PILING Base	STEEL RAILS Per Gross Ton Standard	Light	Re-rolled	TRACK SUPPLIES Angle Bars	Std. Spikes *c*	Tie Plates *c*	Track Bolts
ngham...	$2.10	$2.15	$3.75	$2.55	......	$40.00	$40.00	$39.00	$2.70	$3.00	$2.15	$4.75
go......	2.10	2.15	3.75	2.55	$2.40	40.00	40.00	39.00	2.70	3.00	2.15	4.75
urgh....	2.10	2.15	3.75	2.55	2.40	40.00	40.00	39.00	2.70	3.00	2.15	4.75
lo:......	2.10	2.15	.....	.....	2.40	.....	.....	.....	....	.....	2.15	.....
land.....	2.10	2.15	3.75	2.55	.....	.....	.....	.....	...	.....	.....	.....
gstown...	.....	2.15	.....	.....	.....	.....	.....	.....		3.00	.....	.....
it.......	.....	2.27‡	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
ports....	2.47*a*	2.52*a*	.....	.....	2.85*a*	.....	.....	.....	.....	.....	.....	.....
c ports...	2.75*a*	2.80*a*	.....	.....	2.95*a*	.....	.....	.....	.....	.....	2.30	....

Delivered. *a* F.o.b. cars dock. *b* Rail steel same as billet prices. *c* Other points include Portsmouth, O., Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., and Pacific coast ports, on tie plates alone, Steelton, Pa., on spikes alone, Lebanon, Pa., Richmond, Va. *d* Add switching charge $18 per c.l.

RON AND STEEL PRODUCTS—F.O.B. WAREHOUSE, PER 100 LB., BASE PRICE

	STRUCTURAL SHAPES Per 100 lb. base price	REINFORCING BARS* Per 100 lb., ¾ in., base price 15 tons or over *b* New billet	Rail steel	Add Switch	$/cwt. for Del.	EXPANDED METAL LATH Per 100 sq.yd., carload lots Std. diamond mesh, 3.4 lb	Std. ribbed 3.4 lb.	WELDED FABRIC REINFORCING Per 100 sq.yd., carload lots 4x16 in., No 5 & 10 wires	4x12 in., No 8 & 12 wires	6x6 in. No. 6 & 6 wires Per sq. yd.	SHEET PILING Per 100 lb. base price
ta.........	$2.34	$2.39	$2.39	$.02½	$.10	$21.06	$23.00	$1.82	$1.35	$0.1719	$3.04
more.......	3.70	2.90	2.75	......	.10	22.50	24.50	1.70	1.27	.1611	3.00
ngham.....	2.10*a*	2.15	2.15	.02½	.10	19.00	21.00	1.80	1.34	.1701	....
n..........	3.85	3.51	3.36	$20 C.L.	.10	18.50	29.50	1.76	1.31	.1656	2.70
go..........	2.10*a*	2.15	2.15	.03	.05	21.50	23.50	1.67	1.25	.1575	2.40
nnati.......	3.68	2.53*cd*	2.53*cd*	......	.05	19.50	21.50	1.66	1.25	.1566	....
land........	2.10*a*	2.15	2.15	.02½	.10	19.50	21.50	1.66	1.25	.1566	....
s..........	4.25	3.17	3.17	......	....	25.00	27.50	1.93	1.42	.1827	....
er.........	4.35	3.95	3.85	......	....	26.50	28.50	1.97	1.45	.186	....
oit.........	3.65‡	2.52‡	2.52‡	......	.10	25.50	29.50	1.68	1.26	.1584	2.66
s City.....	4.00	2.61*cd*	2.61*cd*	.0	.05	24.50	26.50	1.78	1.33	.1683	2.89
ngeles......	3.65*f*	2.575	2.425	.02½	.05	23.00	27.50	1.93	1.42	.1827	3.65
eapolis......	3.80‡	2.75	2.75	.0	.10	25.00	27.00	1.80	1.34	.1701	2.75*d*
treal........	4.00*i*	2.90*i*	2.80*i*	......	....	26.00*hij*	33.00*hij*	2.56*i*	3.14*i*	.268*i*	....
Orleans.....	4.40	2.52	2.52	.05	.10	21.50	23.50	1.82	1.35	.1715	2.875
York.......	3.75	2.76*c*	2.76*c*	......	.15	17.50	19.50	1.76	1.32	.1665	2.74
delphia.....	3.66	3.82	....	......	....	19.50	21.50	1.71	1.28	.1611	2.75
burgh.......	2.10*a*	2.15	2.15	.02½	.10	23.00	26.50	1.59	1.20	.1503	2.40
ouis........	3.69	2.7575	2.7575	.0	.05	28.00	34.00	1.69	1.27	.1602	2.70
Francisco....	4.35	2.825	....	.02½	.10	21.00	24.50	1.93	1.42	.1827	3.85
le.........	2.75*e*	2.50*e*	....	......	....	34.50	38.50	1.93	1.42	.1827	2.95*ej*

‡Delivered. *a* Mill prices. *b* 5–15 tons, add 15c. 1–5 tons, add 25c. Less than 1 ton, add 50c. *c* 20 tons or over Base. *d* Mill price plus freight. *e* F.o.b. *f* Includes delivery in free delivery zone. *g* Less than 1 ton, add 25c.; 1 to 5 tons, add 10c. * High scrap steel prices cut former 15c. differences between new and rail steel in many mills. *h* List price. *i* Plus Dominion and Province sales tax. *j* August 1942 price; not on market.

PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

	C. I. PIPE Per net ton f.o.b. 6 in. to 24 in.*a*	VITRIFIED SEWER PIPE Per foot, std. 8 in., s.s.	Delivered std. 12 in., s.s.	ASTM 24 in.,	C13–35 36 in.,	CLAY DRAIN TILE Per 1,000 ft., carload lots, f.o.b. 6 in.	8 in.	CONCRETE SEWER PIPE Per ft., delivered; ASTM 12 in.	C 14–35 24 in.	WROUGHT STEEL PIPE Full standard weight, *h* 1 to 3 in., Butt Weld Black %	Galv. %	3½ to 6 in.; Lap Weld Black %	Galv. %
nta.........	$49.66	$0.26*b*	$0.468*bc*	$1.8525	$4.68*c*	$85.00	$128.00	$0.45	$1.642	48.2	54.2	59.7	51.2
more.......	53.00	.35	.60	2.65	7.25	160.00	200.00	.50	1.75	65.5	57.5	63.0	54.5
ingham.....	45.00	.275	.495	1.95	5.50	100.00	220.00	.50	1.70	62.2	54.2	59.7	51.2
on.........	55.40	.26	.463	2.07	5.85	140.00	......	.60	......	....	....	....	....
ago........	54.33	.35	.675	2.70	7.00	100.00‡	150.00‡	.45	1.85	66.0	55.0	64.5	53.0
innati.......	53.27	.231	.4455	1.80	5.125	105.00	170.00	.60	1.70	57.1	43.4	54.0	39.6
eland........	54.75	.196	.378	1.62	4.715	81.00	125.00	.36	1.40	68.5	57.5	66.0	54.5
s..........	56.43	.31	.58	2.25	5.00	90.00	110.00	.46	1.57	59.9	51.9	57.3	48.3
er.........	61.56	.29†	.52†	2.16†	3.00*n*	130.00	240.00	.50	1.70	58.4	50.4	55.7	47.2
oit.........	54.75	.252	.486	2.09	7.16	78.00	127.00	.36	1.60	57.7	44.0	54.8	40.6
as City.....	55.73	.315	.39	2.20	5.86	140.00	260.00	.45	1.60	35.9	46.4	46.6	59.9
Angeles......	68.40	.282†	.508†	2.034†	5.085†	115.50	192.50	1.00	2.00	59.6	51.6	57.0	48.6
eapolis......	59.00	.275†	.495†	1.98†	5.37†	......	......	.90	2.10	64.2	53.2	60.7	49.2
treal........	60.00	.85	1.50	5.25	8.50*e*	45.00*m*	64.00*m*	.48*m*†	1.92*m*†	....	....	....	....
Orleans.....	51.78	.26	.48	1.69	......	150.00	220.00	.45	1.65	62.4	54.4	58.8	50.3
York.......	52.40	.322	.621	2.43	6.15	......	......	.60	1.40	64.9	53.9	62.4	50.9
delphia.....	51.00	.28	.54	2.30	6.75	150.00	225.00	.45	1.75	56.6	42.8	53.6	39.1
burgh.......	56.00	.245†	.4725†	1.845†	5.4325	97.80	154.20	.85*g*	2.00*g*	68.5*i*	57.5*i*	66.0*i*	54.5*i*
Louis........	52.84	.28	.504	2.016	4.50	85.00	220.00	1.00*j*	2.15*k*	56.4	42.6	52.5	38.4
Francisco....	68.40	.3625*d*	.6525*d*	2.61	6.52	115.50	192.50	.58	2.34	45.0	31.0	41.0	26.0
tle.........	70.20	.375	.675	2.70	6.75	84.00	187.50	.51*f*	1.44*f*	....	....	....	......

Delivered. †F.o.b. *a* B. & S. class B and heavier, C/L lots, 200 tons and Burlington, N.J. (base) $49.00. Based on existing freight rates; subject to change. Gas pipe and class A, $3 per ton additional, 4 in., $3 per ton ional, 30 in. and larger usually $2 per ton less. *b* Double strength. *c* List ealer. *d* List. *e* 30-inch. *f* Less 5% for cash. *g* Culvert pipe. *h* Discounts from standard list consumers carload prices, except Pittsburgh prices .o.b. mill. Base price $200 per net ton. List prices per ft.; ½ in., 8½c.; 11½c.; 1 in., 17c.; 2 in., 37c.; 2½ in., 58½c.; 3 in., 76½c.; 4 in., $1.09; 6 in., $1.92. cent tax on transporation costs not included.

i Applies also at Lorain, Ohio, mills. Chicago delivered base is 2½ points less on butt, 1½ on lap. Freight is figured from Pittsburgh, Lorain, O., Chicago Dist. Billing is from point producing lowest price at destination. WROUGHT IRON PIPE: Base price and list prices per ft. same as wrought steel pipe. Discount for Pittsburgh base: Butt-weld—1 in. and 1¼ in. black 34, galv. 16; 1½ in. black 38, galv. 18½; 2 in. black 37½, galv. 18. Lapweld—2½ in. to 3½ in. black 31½, galv. 14½; 4½ in. to 8 in. black, 32½ galv. 17. *j* Reinforced; spec. C 76–37. *k* Reinforced; spec. C 75–37. *l* Plus sales tax. *m* Tax included. *n* 27-in. pipe.

LUMBER, TIMBER PLYWOOD—PER M FT., B.M., CARLOAD LOTS F.O.B.

SHORT LEAF YELLOW PINE AND DOUGLAS FIR — **All S. L. Y. P. is No. 2 common or better and for No. 1 N. C. Box. (Prices in Bold Face)** *All Fir planks No. 2 common, Fir timber is No. 1 common. Lengths up to 20 ft. (Prices in italics)*

LONG LEAF Y. P. — Merchantable grade up to 20 ft.

PLYWOOD — Rail freight incre… (See note for base…

	Short Leaf Yellow Pine and Douglas Fir									Long Leaf Y. P.		Plywood	
	1x6 S4S	1x8 S4S	2x4 S4S	2x6 S4S	2x8 S4S	2x10 S4S	3x12 Rgh	6x12 Rgh	12x12 Rgh	2x12 Rgh	12x12 Rgh	⅝"	
Atlanta	**$33.00**	**$33.00**	**$28.00**	**$27.00**	**$27.00**	**$30.50**	**$46.00**	......	......	$54.00	$62.00	$17.90	$21.
Baltimore	**40.00**	**43.00**	**40.00**	**40.00**	**41.00**	**45.00**	**60.00**	......	......	110.00	115.00	18.25	22.
	48.00	*48.00*	*52.00*	*52.00*	*52.00*	*52.00*	*68.00*	*$70.00*	*$70.00*	......	......	......	...
Birmingham	**34.50**	**36.50**	**32.00**	**32.00**	**34.00**	**34.00**	**53.00**	**53.00**	**56.00**	......	......	17.35	21.
¹	37.50	37.50	37.00	37.00	37.00	43.00	65.00	......	......	67.50	70.00	......	...
Boston ‡*	......	......	50.00³	55.00³	......	......	......	......	......	......	......	18.25	22.
‡*	*45.00*	*45.00*	*50.00*	*55.00*	*60.00*	*70.00*	*75.00*	*80.00*	*80.00*	......	......	......	...
Chicago	**42.00**	**43.00**	**41.00**	**40.00**	**41.00**	**42.50**	**60.00**	......	......	80.00	95.00	14.60	17.
	50.00	*50.00*	*47.50*	*47.00*	*47.00*	*48.00*	*57.00*	*56.50*	*58.00*	......	......	......	...
Cincinnati	**41.00**	**42.50**	**39.00**	**40.50**	**42.00**	**43.00**	**53.00**	......	......	65.00	68.00	17.35	21.
	......	......	......	......	......	......	*55.50*	*55.50*	*55.50*	......	......	......	...
Cleveland	**42.50**	**42.50**	**52.50**	**51.00**	**51.00**	**54.00**	**78.00**	70.00	70.00	......	......	17.75	21.
Dallas *e*	**41.50**	**42.50**	**38.50**	**37.00**	**37.50**	**38.50**	**53.50**	**53.00**	**53.00**	78.00	83.00	14.60	17.
Denver ‡	54.00⁴	52.00⁴	55.00⁴	55.00⁴	55.00⁴	56.00⁴	59.00⁴	*73.00*	*79.00*	......	......	10.45	12.
Detroit	**44.00**	**44.00**	**44.00**	**43.50**	**44.00**	**46.00**	**60.00**	......	......	53.00	63.00	17.35	21.
	......	......	......	......	......	*51.50*	*55.00*	*60.00*	*60.00*	......	......	......	...
Kansas City	**50.00**	**55.00**	**52.00**	**52.00**	**52.00**	**55.00**	**75.00**	......	......	75.00	85.00	12.60	15.
	50.00	*55.00*	*55.00*	*55.00*	*55.00*	*56.00*	*75.00*	*80.00*	*80.00*	......	......	......	...
Los Angeles *a*	*55.00*	*55.00*	*53.00*	*53.00*	*51.00*	*51.00*	*57.00*	*65.00*	*56.00*	......	......	9.90*gh*	12.
Minneapolis ‡*b*	49.00⁶	49.00⁶	......	......	......	......	......	......	......	......	......	12.60	15.
‡	*53.00*	*53.00*	*53.00*	*52.00*	*52.00*	*53.00*	*59.00*	*61.00*	*61.00*	......	......	......	...
Montreal †⁷	*52.00*	*55.00*	*48.00*	*52.00*	*54.00*	*60.00*	......	......	......	200.00	200.00	......	...
	42.50	*42.50*	*45.25*	*45.25*	*45.25*	*46.75*	*50.00*	*50.00*	*50.00*	......	......	......	...
New Orleans	**31.50**	**31.50**	**33.75**	**31.75**	**34.00**	**35.00**	**48.00**	......	......	69.00	69.00	14.60	17.
	31.00	*31.00*	*33.00*	*31.00*	*34.00*	*32.00*	*33.00*	......	......	......	......	......	...
New York ‡*j*	**60.50**	**61.50**	**56.25**	**55.25**	**56.25**	**59.50**	**67.50**	......	......	120.00*f*	125.00*f*	18.35	22.
‡	......	......	*65.00i*	*65.00i*	*65.00i*	*65.00i*	[Range from $75 to $95]			......	......	......	...
Philadelphia	**50.75**	**50.75**	**51.75**	**50.00**	**50.00**	**52.75**	**70.00**	......	......	110.00	107.75	18.25	22.
	......	......	*65.00*	*65.00*	*65.00*	*65.00*	*67.50*	*$75 to $95*	*$75 to $95*	......	......	......	...
Pittsburgh	**50.80**	**53.20**	**62.75**	**55.00**	**60.85**	**62.50**	**76.25**	......	......	......	......	18.10	22.
	69.20	*68.10*	*66.10*	*65.30*	*65.20*	*65.65*	*88.75*	*88.75*	*88.75*	......	......	......	...
St. Louis ‡*c*	**52.00**	**52.00**	**49.00**	**48.00**	**49.00**	**52.00**	**67.00**	*74.00*	*74.00*	85.00	84.00	14.60	17.
San Francisco *d*	*35.50*	*35.50*	*37.00*	*37.00*	*36.50*	*36.50*	*40.50*	*49.50*	*49.50*	.....	......	7.30*g*	8.
Seattle	*35.00*	*35.00*	*35.00*	*35.00*	*35.00*	*35.00*	*40.00*	*40.00*	*40.00*	......	......	0.00	0.

Bold Face type, Southern Pine. *Italics, Douglas Fir.* ¹ Long leaf. ² Roofers' N. C. Pine. ³ Spruce. ⁴ Native. ⁶ Western Pine, No. 3 Common. ⁷ Spruce. ⁸ Norway Pine. ‡ Delivered. *a* Yard prices. *b* Contractors discount in Minneapolis and St. Paul discontinued May 21, 1938. *c* 5M ft. or less. *d* F.o.b. cars San Francisco freight rate. *e* 10% discount taken off. *f* Up to 18 ft. † Plus sales tax. * Prices for truck delivery; no longer quoting carload lots f. o. b. city.

Note: Special concrete form grade Fir Plywood, 4′ by 8′ panels, 5-ply, 2 sides, water resistant glue, carload lots, delivered per 1,000 sq. ft. Seattle base price on ⅝", $95.15; on ¾", $104.85; price includes oiling and ing charges. For other centers add rail freight increment from table or size. For resin dipped treatment, add $10.50 per M. *g* Lower rate by shipment. *h* 50,000 lb. minimum. *i* Ranges from $65 to $69. *j* Average

GLASS, EXPLOSIVES, CHEMICALS

	WINDOW GLASS — Discounts from jobbers list, Aug. 15, 1938 Single or Double Thickness		EXPLOSIVES — Per lb. 40% Ammonia Gelatin in 50-lb. cases delivered in 200 lb. lots*
	A quality	B quality	
Atlanta	75%	75%	$0.15
Baltimore	78%	79%	.15
Birmingham	76%	76%	.105
Boston	77%	78%	.15
Chicago	77%	77%	.15
Cincinnati	71–10%	71–10%	.15
Cleveland	77–10%	77–10%	.19
Dallas	76%	76%	.1625
Denver	76%	76%	.155*e*
Detroit	77%	77%	.1575
Kansas City	76–10%	76–10%	.155
Los Angeles	86%*d*	88%*d*	.1575
Minneapolis	77%	77%	.155
Montreal	40–5%‡	47%‡	.1675†
New Orleans	70%	75%	.16
New York	81%	82%	.22*f*
Philadelphia	78%	79%	.15
Pittsburgh	79%	79%	.1225
St. Louis	77–10%	77–10%	.155
San Francisco	66–15%	73–15%	.155
Seattle	75%	75%	.1575†

Price of 60% Ammonia Gelatin in $0.01 per lb. higher than 40%

a Disc. from list Sept. 1939. *b* Also less 6% tax exemption. *d* Discount from jobbers' list Sept. 15, 1928. ‡ Sales tax included.

* Urban prices influenced by service charges or local storage and delivery regulations, do not consistently reflect quantity prices in less congested areas. *e* F.o.b. Louviers, Colo. *f* In boroughs of Kings, Queens and Richmond, and in Manhattan south of Canal Street, add delivery charge of $6.00 per trip. † F.o.b.

40% Ammonia Gelatin price ranges in other than urban areas, per lb. (except Seismograph Grades)

	C/L 20,000 lb. net	Tons	200 lb. lots
E. of the Miss., except Fla. and Me	$0.105	$0.13	$0.15
W. of Miss. to Rocky Mtn. States, Fla. and Maine.	.11 –.1175	.135 –.1475	.155 –.1675
Rocky Mtn. States	.11 –.1225	.135 –.1525‡	.155 –.1725‡
Pacific N. W. States	.1075–.12	.1375–.15	.1575–.17
Pacific S. W. States	.1050–.1125	.135 –.1425	.155 –.1625

‡ F.o.b. Louviers, Colo., or Butte, Mont.

PILES, TIES—F.O.B.

PILES

Prices per linear foot, pine, with bark on, f.o.b. New York; delivered barge 1½ to 2c. per ft. additional:

Dimensions	Points	Length	Short Leaf — Barge
12 in. at butt	6 in.	30 to 50 ft	...
12 in.—2 ft. from butt	6 in.	50 to 59 ft	...
12 in.—2 ft. from butt	6 in	60 to 69 ft	...
14 in.—2 ft. from butt	6 in.	50 to 69 ft	...
14 in.—2 ft. from butt	6 in.	70 to 79 ft	...
14 in.—2 ft. from butt	5 in.	80 to 85 ft.	...
14 in.—2 ft. from butt	5 in.	85 to 89 ft.	...

RAILWAY TIES

Prices f.o.b., per tie for carload lots:		6″x8″x8′		7″x9″x8′6″	
		Untr.	Tr.	Untr.	Tr.
Boston	Oak	$1.50	....	$2.00	...
	Pine	2.00	$3.00*a*	3.00	$3.5
New York	S. L. Sap Pine	1.43/1.54	2.59	1.76	2.9
	Mixed Oak	1.71	2.59	2.42	3.5
Birmingham	White Oak	1.00	1.60*a*	1.30	2.2
	Southern Pine	....	....	....	
Chicago	Red Oak	....	2.19*a*	....	2.87/3.
	Southern Pine	....	....	....	...
Los Angeles	Douglas Fir	1.10	1.75*a*	1.60	2.5
Philadelphia	Red Oak	....	2.10*ag*	....	3.2
St. Louis	White Oak	1.65*	....	1.90*	...
	Red Oak	1.55*	2.15*a**	1.90*	2.7
	Sap Pine or Cypress	1.35*	....	1.70*	...
San Francisco	Douglas Fir	1.15*bef*	....	....	3.0
Montreal	Birch or Maple	.85	.95	...†	...

Tr.—Treated; Untr.—Untreated. *a* Creosoted *b* 6″x8″x8′6″. *c* cell. *d* Zinc. *e* Green. *f* F.o.b. cars. † Out of market. * September price, OPA ceilings effective. *g* January price, none later available.

CHEMICALS

Water, sewage treatment road work, f.o.b. carlots, New York

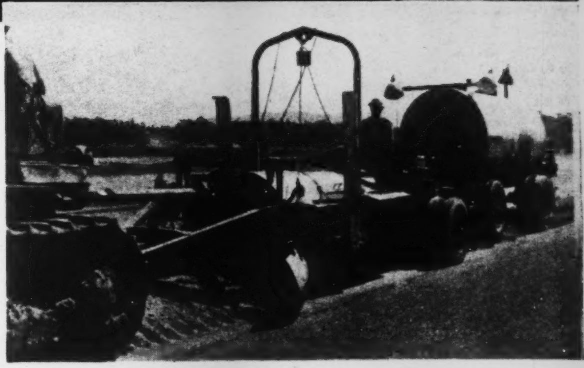
Bleaching powder, in drums, f.o.b. works, per 100-lb.	$2.50-
Chlorine cylinders, liquid, per lb. delivered	
Calcium chloride, 77–80%, flaked, in 100-lb. paper bags, delivered, per ton	18.50-
Silicate of soda, 52 deg., in drums, f.o.b. works, per 100 lb.	
Soda ash, 58%, in paper bags, per 100 lb. dense	
Sulphate of aluminum, commercial, in 100-lb. bags, per ton	23.00-
Sulphate of copper, in bbl., per 100-lb.	5.00-

ROAD-MIX CUT TIME ON THIS JOB BY 1/3

Seal Coating A Wood Roadmixer Job

Native and local materials ying *at or near the job* were used. Saving equipment and labor

Build it good and build it quick." That's how your ving contract reads today; that's why more and ore paving jobs are designed for Road-mix. Road-ix methods of pavement construction use native d local materials, which cuts material hauling costs a minimum. Road-mix uses the mix-in-place or aveling plant method of mixing, which eliminates he central plant and additional hauling. The result a faster job with less manpower, less equipment d with savings as much as 1/3 in costs. Road-mix ethods of pavement construction, either emulsion, ad oils or soil-cement, can be used anywhere pav-g can be laid. Hundreds of miles of roads, streets d highways, and millions of square yards of land-g fields and runways offer highest testimony to the p-quality paving produced by Road-mix methods. efore you design your next job, get all the facts on oad-mix—the modern, money-saving, time-saving ethod of pavement construction.



WOOD ROADMIXER

A COMPLETE TRAVELING MIXING PLANT

Compactly designed, ruggedly constructed, easy to operate. Requires only a standard crawler tractor and a supply truck. Two men can handle the entire unit. As the pioneer and leading traveling plant method of pavement construction, the Wood Roadmixer is the lowest in price, lowest in operating cost and lowest in maintenance cost of all proven mix-in-place methods. Working on compacted base or with loose windrows, using emulsion, road oils or soil-cement, the Wood Roadmixer delivers higher production than any other method of pavement construction. Highest quality paving is assured by accurate volume control of aggregate and binder, and carefully regulated mixing action to meet conditions of every job. Easily hauled or towed from job to job. Own a Wood Roadmixer—and you can design, bid and build Road-mix.

➡ ➡ ➡ DESIGN FOR ROAD-MIX

Write for detailed and illustrated Wood Roadmixer bulletin, "The Fastest Method of Low-Cost Paving."

WOOD ROADMIXER

Wood Manufacturing Co. • 816 West 5th St., Los Angeles, California

STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME—DELIVERED

	STRUCTURAL CLAY TILE—PARTITION—SCORED Per M. lots of 2,000 pieces or over, 3x12x12 in.	4x12x12 in.	8x12x12 in.	STRUCTURAL CLAY TILE—LOAD BEARING—SCORED Per M. lots of 2,000 pieces or over, 8x12x12 in.	10x12x12 in.	12x12x12 in.	BRICK Per M. in quantity. Common backing	Straight hard	LIME Per ton, Hydrated finishing	In paper, Common hydrated	Carloa Pulve or lu
Atlanta	$104.00	$114.00	$199.00	$234.00	$244.00	$250.00	$13.50	$18.00	$26.50	$15.04	$15.
Baltimore	84.00	90.00	170.00	200.00	260.00	320.00	15.00*k*	19.00*k*	18.00	13.00	2.
Birmingham	80.00	85.00	160.00	191.00	252.00	288.00	14.50	17.00	18.11	13.64	2.
Boston	89.35*a*	93.30*a*	178.70*a*	202.50	271.80	308.20	16.50*i*	19.50*i*	17.50†	12.50†	14.
Chicago	72.00	77.00	145.00	197.00	243.00	278.00	12.50	13.50	17.00	15.00	12.
Cincinnati	65.55	69.90	131.20	148.70	210.35	240.45	17.50	17.50	15.50	13.00	....
Cleveland	60.00	64.00	120.00	144.00	193.00	221.00	17.00	17.00	15.75*j*	13.25*j*	3.
Dallas	62.50	67.50	135.00	162.00	212.50	263.00	13.50*i*	15.00*i*	19.00	15.00	
Denver	84.80	95.40	153.70	178.20	212.00	227.90	14.50	17.00	25.00*j*	17.00*j*	20.
Detroit	86.05	91.80	172.10	213.00	268.00	330.00*e*	17.50	18.00	18.00	16.00	16.
Kansas City	67.00	69.00	89.00*c*	128.00	163.00	189.00	15.50	16.50	19.32	13.00	10.
Los Angeles	73.50†*r*	89.50†*r*	128.00*c*†*r*	210.00†*r*	368.00†*r*	460.00†*r*	13.50	15.00	16.50	17.50	17.
Minneapolis	81.95*b*	87.40*b*	148.70*b*	......	179.30*b*	249.35*b*	13.60	15.60*g*	21.00	16.00	19.
Montreal	99.10*a*	105.65*a*	154.75*a*	101.65*at*	154.75*au*	155.25	24.10†*u*	27.25†*u*	24.60*u*	18.00*u*	....
New Orleans	72.00	72.00	135.00	162.00	210.00	260.00	14.00	.....	18.30	12.08	14.
New York	78.40	83.60	115.00*c*	193.30*h*	238.80*h*	295.60*h*	15.00*r*	.....	20.00	14.00	17.
Philadelphia	90.00	97.70	183.20	197.10	243.20	301.10	17.00	20.00	15.75	9.00	11.
Pittsburgh	62.35	66.55	124.75	140.25	173.25	198.00	17.50	19.50	17.90	15.40	2.
St. Louis	67.00	95.00	130.00	190.00	244.00	290.00	18.00	17.00	22.00	18.00	24.
San Francisco	84.00	94.50	225.00	......	......	......	17.50	22.00	20.00	20.00	16.
Seattle	115.00	125.00	230.00	......	......	......	20.00*f*	21.00*f*	20.00*s*	20.00*s*	20.

† F.o.b. *a* Smooth. *b* Carload lots delivered to job. *c* 6x12x12 in. *d* Not load bearing. *e* 48 lb. tile. *f* Less $1.00, ½ cash 15 days, balance 30 days. *g* Selected common. *h* F.o.b. Perth Amboy, N. J. *i* F.o.b. Warehouse only. *j* LCL. *k* $1.00 discount if paid in 10 days. *l* Lump. *m* Per bbl., 1 *n* Per sack 100 lb. *o* Per bbl., 200 lb. *p* 280 lb. bag. *r* 5% discount 10 *s* 2% discount for cash. *t* 5¼x8x12. *u* 8% sales tax included. *v* April pri

PAINT, ROOFING—F.O.B. CARLOAD LOTS

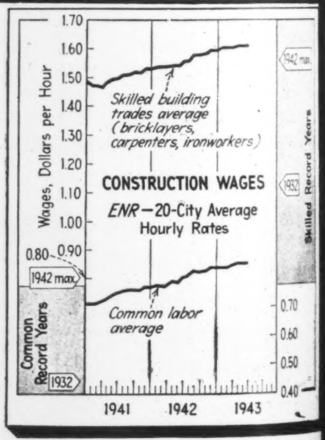
	RED LEAD Per 100 lb. in 600-lb. (Approx.) bbl Dry *a*	WHITE LEAD Per 100 lb. in oil	READY-MIXED PAINT Per gal., drums Graphite *b*	Aluminum *b*	Ferric Oxide *d*	ROOFING SUPPLIES Carload lots f.o.b. factory Rolls, slate surfaced, 85–90 lb. per sq	Asphalt felt, per 100 lb.	Tar felt, per 100 lb.	Asphalt coating per gal.	Tar pi 350 lb. per to
Atlanta	$10.25	$14.125	$1.30	$2.25	$1.20	$1.90	$1.61	$1.61	$0.27	$29.0
Baltimore	10.00	13.75	2.00	3.00	2.50	2.30	2.70	2.70	.40	29.0
Birmingham	10.25	14.125	2.35	3.50*r*	1.98*r*	2.04	1.97	1.97	.32	28.3
Boston	10.00	13.75	1.60	....	2.40	2.12‡	1.72*h*‡	1.72*h*‡	.50‡	20.0
Chicago	10.00	13.75	....	....	....	1.75*hf*	1.74*hf*	1.82*hf*	.33*f*	23.0
Cincinnati	10.00	13.75	1.70	2.90	1.60	2.40	2.39*h*	2.39*h*	.36	21.0
Cleveland	10.00	13.75	2.10	4.80	1.95	1.93	1.83*h*	1.83*h*	.35	29.0
Dallas	10.00	14.50	1.88	2.11*n*	.05*l*	1.75*h*	1.66*h*	1.66*h*	.35	39.0
Denver	10.50	14.25	1.65	....	.27*l*	2.45	3.15	3.15	.35	28.00
Detroit	10.00	13.75	1.75	3.00	1.60	2.10	2.06	2.06	.35	23.0
Kansas City	10.00	13.875	2.39*g*	2.55*gr*	2.16*gn*	2.10	2.30	2.30	.28	27.50
Los Angeles	10.25	14.25	1.60	2.25	2.30	2.10	1.50	....	.45	....
Minneapolis	10.00	13.875	....	....	....	1.75*i*	1.66*hi*	1.66*hi*	.32	23.0
Montreal	9.25	6.25	2.50*p*	4.90*p*	3.15*p*	2.67	2.07	2.07	.94	1.8
New York	10.00	13.75	2.03	....*r*	1.64	1.66	1.58*h*	1.58*h*	.26	25.00
Philadelphia	10.00	13.75	....	....	....	1.75	1.66	1.66	.32	23.0
Pittsburgh	10.00	13.75	1.05	1.95	.80	1.95	1.94*h*	1.94*h*	.34	26.00
St. Louis	10.00	13.75	2.28*s*	2.89*s*	1.96*s*	1.66	1.66	1.66	.35	24.00
San Francisco	10.25	14.00	1.80	2.75*n*	1.35/2.35	1.71	2.40	2.40	.33	19.50
Seattle	10.25	14.25	1.90	3.00	....	2.15	2.16*h*	....	.35	26.50

‡ Delivered. Note: Red lead in oil 50c. higher than white lead in oil. *a* Red lead prices change frequently due to pig lead price changes. *b* U. S. War Dept. Spec. 3-49A. *c* ASTM Spec. D266-31. *d* 80% minimum ferric oxide. *e* Subject to 25% discount. *f* Distributors' price to contractors. *g* 5 gal. can. *h* Per roll, 65 lb *i* Minneapolis and vicinity. *j* Asphalt pitch. *k* Per 10 *l* Per lb. *m* Per bbl. *n* May, 1941 price, no later quotation available. *p* 8% sales tax. *r* Not available, except on priority rating; then quoted speci *s* December price.

SKILLED AND COMMON WAGE RATES—PER HOUR

	Bricklayers	Carpenters	Struct. Iron Workers	Hoisting Engineers	Plasterers	Common Labor Building	Heavy Const.
Atlanta	$1.50	$1.25	$1.375	$1.25	$1.50	$0.40	$0.50
Baltimore	1.75	1.375	1.80	1.625/1.80	1.50	.75	.75
Birmingham	1.75	1.125/1.25	1.50	1.25/1.50	1.50	.65	.65
Boston	1.625	1.50	1.65	1.875	1.667	.80/1.00	.80/1.00
Chicago	1.75	1.70	1.76	1.75	1.825	1.10	1.10
Cincinnati	1.75	1.50	1.675	1.45/1.60	1.625	.85	.85
Cleveland	1.75	1.55	1.75	1.75	1.75	1.00	1.00
Dallas	1.625	1.25	1.50	1.75	1.625	.60	.75/1.25
Denver	1.65*b*	1.50*b*	1.625*b*	1.43*b*	1.51*b*	.80*b*	.80*b*
Detroit	1.675	1.50	1.75	1.625/1.75	1.675	.90	.90
Kansas City	1.65	1.50	1.625	1.625	1.65	.90	.90
Los Angeles	1.50	1.35	1.625	1.375	1.667	.875	.875
Minneapolis	1.50	1.375	1.50	1.40	1.50*e*	.925	.925
New Orleans	1.50	1.25	1.50	1.50	1.375	.65	.75
New York	2.00*b*	1.85*b*	2.00	2.00*b*	2.00*b*	1.031	.95
Philadelphia	1.90	1.50	1.90	2.00	2.00	.825	.825
Pittsburgh	1.90	1.75	1.75	1.8125	1.875	.90	.80
St. Louis	1.75	1.50	1.75	2.00	1.75	.95	.95
San Francisco	1.75	1.50	1.75	1.50/1.75	1.75	.95	.95
Seattle	1.78	1.48	1.68	2.00	1.78	1.08	1.10
Montreal	.965	.855	.90	.80	.945	.505	.505

b 7 hr. day *e* 30 hr. wk



ENR Skilled Average; (Bricklayers, Carpenters, Ironworkers) $1.
ENR Common Average; $0.863

SMOOTH runways for smooth landings

VINSOL*-TREATED CEMENT RESISTS SCALING

LIKE BUSY HIGHWAYS . . . airport runways and taxiing surfaces have to be kept free of snow and ice throughout long northern winters!

This necessity has created a serious problem for both contractor and operator . . . because constant freezing, thawing, and the action of de-icing agents tend to destroy the surface of concrete, causing it to crack and scale.

Vinsol*-treated Cement Provides Answer!

Experiences of leading cement companies, highway departments, and engineering consultants show that Vinsol-treated cement resists scaling under the most severe weather and de-icing conditions. When Vinsol-treated cement has been laid side by side with normal portland cement, it has shown no tendency to scale, while the normal portland has scaled right up to the separation joints!

Contractors Enthusiastic!

Furthermore, contractors using Vinsol-treated cement report that it saves time and money in laying. Not only is it easier and quicker to spread but it is faster to finish. Because there is less bleeding and segregation, crews are able to work closer to the mixer and thus keep up to schedules.

Ask Your Cement Supplier!

Your supplier probably has Vinsol-treated cement with full instructions for its use. We have published a 44-page compilation of articles prepared by engineering authorities. Everyone working with cement should read this booklet, "Better Roads Ahead." Fill out and mail the coupon below for your copy.

g. U. S. Pat. Off.

Specify Vinsol-treated Cement for Longer Surface Life

NAVAL STORES DEPARTMENT
HERCULES POWDER COMPANY
INCORPORATED
940 KING ST., WILMINGTON, DELAWARE

Gentlemen:
Please send me a copy of 44-page book, Better Roads Ahead, telling the complete story of Vinsol-treated cement.

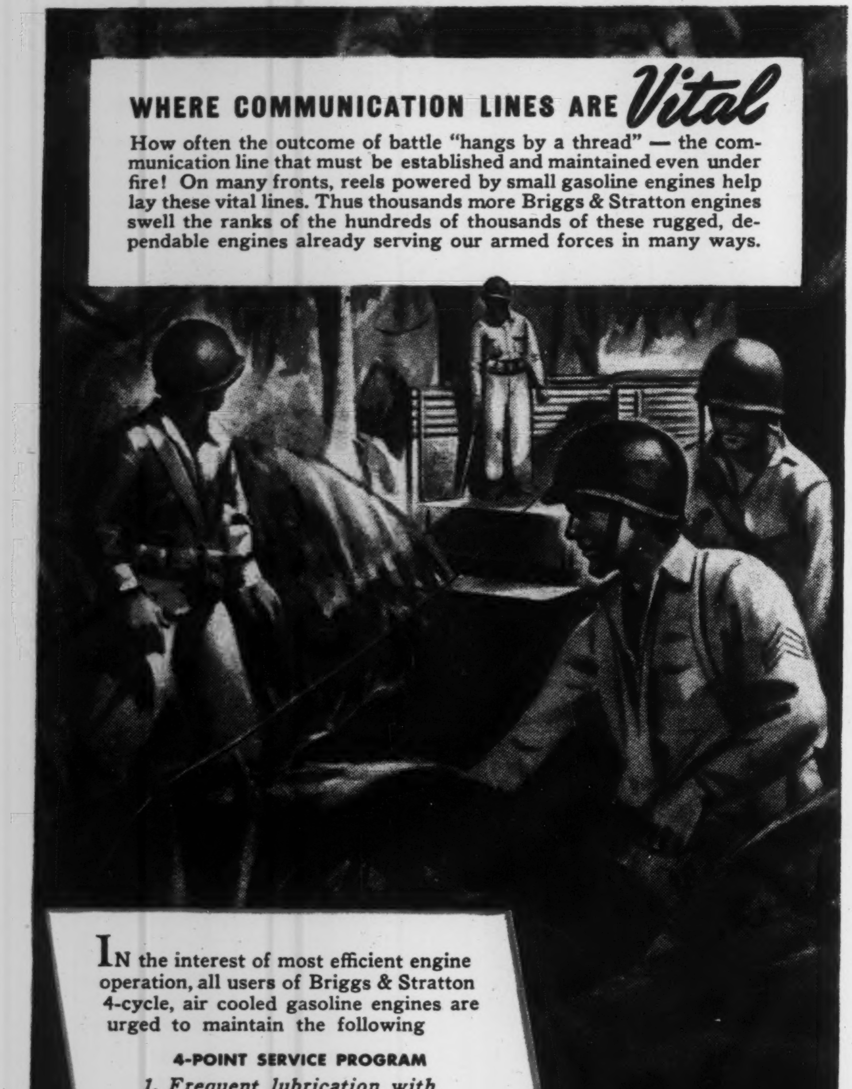
*Name*____________________

*Company*________________ *Title*__________

*Address*____________________

*City*________________ *State*__________

LL-92



WHERE COMMUNICATION LINES ARE *Vital*

How often the outcome of battle "hangs by a thread" — the communication line that must be established and maintained even under fire! On many fronts, reels powered by small gasoline engines help lay these vital lines. Thus thousands more Briggs & Stratton engines swell the ranks of the hundreds of thousands of these rugged, dependable engines already serving our armed forces in many ways.

IN the interest of most efficient engine operation, all users of Briggs & Stratton 4-cycle, air cooled gasoline engines are urged to maintain the following

4-POINT SERVICE PROGRAM

1. *Frequent lubrication with proper oils.*
2. *Periodical engine inspection.*
3. *Always keep engines properly adjusted.*
4. *Keep engines clean.*

This systematic care will not only assure better, longer engine service — but will prevent unnecessary repairs, thus saving critical materials for war uses.

So, keep your engines in good condition. Your nearest dealer or Briggs & Stratton Service Station will gladly help you.

BRIGGS & STRATTON CORP.
MILWAUKEE, WIS., U. S. A.

Invest In Freedom
BUY WAR BONDS

4 CYCLE
BRIGGS & STRATTON
GASOLINE ENGINES

NEWS OF THE WEEK

(*Continued from p. 92*)

City planning role important in war effort

City planning agencies got full
perience last year in their dou
role of laying out for present ne
and predicting for the future as th
were called upon to solve curr
problems in war housing and co
munity facilities, with an eye to f
filling after-war needs where
possible.

Activities of a majority of
1,200 local planning bodies duri
1942 fell into two classificatio
according to the American Socie
of Planning Officials. First, work
connection with actual war pro
lems ranging from roads to housin
An example was the close cooper
tion between the Denver plan co
mission and the Army headquarte
in that area in solving army plannin
problems.

Second, preparation of capit
budgets and public works program
for post-war operation. This wo
was taken over by the local gover
ments when the Federal Public Wo
Reserve, which stimulated it, we
out of existence.

Zoning, long familiar planning to
for regulating land-use, gained ne
prominence in 1942 as temporar
modifications were made in existin
ordinances to meet demands of th
national homes use program fo
accommodating war workers. Thos
cities making concessions, accordin
to the society, are relaxing zonin
regulations for the duration only.

In connection with postwar plan
ning, a number of city plan agencie
urged that surpluses accruing be
cause of declining municipal em
ployee lists and inability to obtain
construction material should be used
to prepare plans and build a finan
cial backlog for the future.

• • •

Driverless ditcher digs trenches under fire

Many fascinating stories on the use o
construction equipment will come out o
the war, but few will top an inciden
reported in the April issue of the B

ixer, house organ of the Barber-Greene o. On the North African front a model -C B-G ditcher was working toward e enemy lines digging a trench. The nfortunate operator was dislodged from is seat by a shot, but as he toppled om the machine the travel and bucket-ne clutches remained engaged at slow peed.

The machine continued to dig and ravel straight ahead into the enemy ines. Troops, protected by the trench, ollowed close behind the driverless itcher.

The report does not say how far the achine went before it was stopped by nemy fire, but it does hint at a "mili-ary advantage" gained by this unusual ccurrence.

• • •

Large new loan for Kaiser plant

The Reconstruction Finance Corpora-ion recently approved a new loan of ore than $21,000,000 for use in the evelopment of Henry J. Kaiser's steel lant at Fontana, Calif.

The new loan brings the total amount pproved for the plant to more than 105,000,000.

The exact use to which the new loan ill be put has not been disclosed.

• • •

Municipal water supplies maintained despite floods

Continuous supplies of safe drinking water were maintained for several towns in southern South Dakota, last month, despite severe flood conditions of the Missouri River and its tributaries, including the James, Elm and Grand rivers, as reported by the South Dakota State Board of Health, division of sanitary Engineering, in its publication "The Clorifier." Considerable resourcefulness was required to avoid interruption of waterworks operations during the several days in which supply systems, both public and private, were flooded by the high waters.

A shallow well furnishing water for the city of Ft. Pierre was submerged under several feet of muddy Missouri River water, as was also the city power plant. Fortunately, the city's elevated water storage reservoir had been completely filled and by conserving the flow of water an adequate supply was maintained throughout the five days the well was out of service. A chlorinator at the well provided quick restoration of the supply with only a minimum delay for pumping necessary waste water and sterilization of the well. Heavy chlorina-

THE PUMP THAT

Stays on the job!
CARVER
Certified
PUMPS

ON the really *tough* pumping jobs where dirt, sand and grit take rapid toll of ordinary pumps, rugged CARVER centrifugals are setting records for consistent high performance. Long, trouble-free service is a job-tested *fact* about CARVER pumps that will mean dollars and hours saved on *your* job, for these outstanding centrifugals maintain their lightning-fast prime, their extremely high efficiency, even after thousands of hours of pumping.

For a pump that starts out ahead and *stays* ahead—specify CARVER on your job!

•

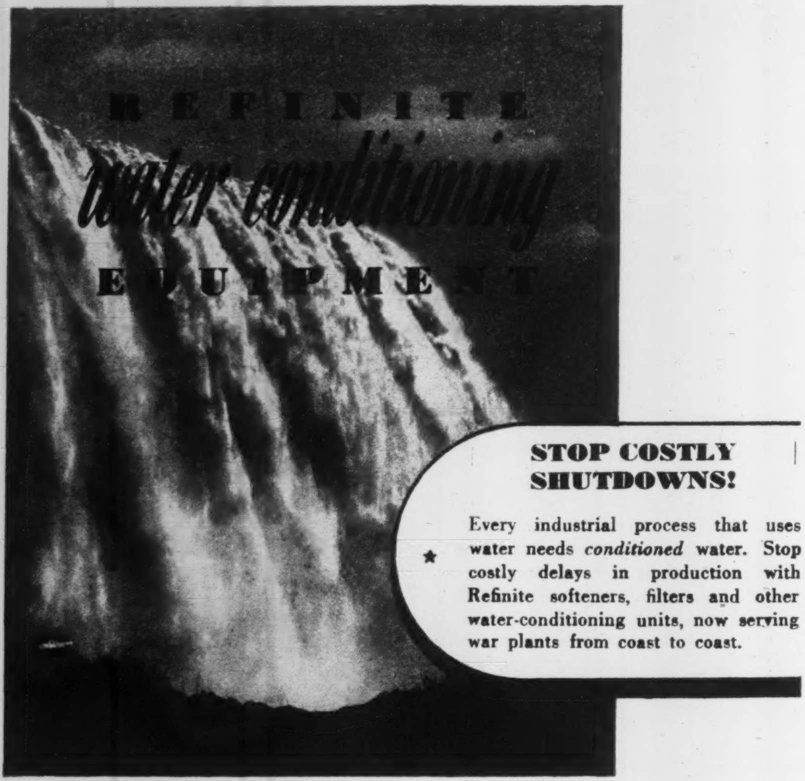
Gas engine, electric motor or belt-driven CARVER centrifugals are built in capacities from 5,000 to 125,000 G.P.H.

•

Get the *facts* about these efficient, long-lived pumping units — write NOW for your copy of the CARVER pump catalog.

CARVER PUMP CO., Muscatine, Iowa

CARVER CENTRIFUGAL Certified PUMPS

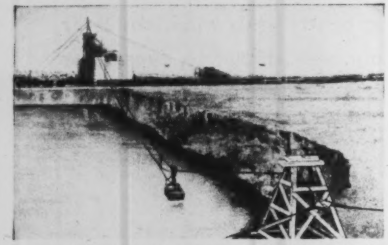


STOP COSTLY SHUTDOWNS!

Every industrial process that uses water needs *conditioned* water. Stop costly delays in production with Refinite softeners, filters and other water-conditioning units, now serving war plants from coast to coast.

Write For Catalog • THE REFINITE CORPORATION
101 REFINITE BLDG. OMAHA, NEBRASKA

More Yardage with Less Labor



This Sauerman Slackline Cableway digs down to the bottom of a deep gravel deposit and hauls the material to top of screening plant at cost of 4¢ per cubic yard.

Here is a small Sauerman Scraper (¼ cu. yd. size) moving sand from stockpile to concrete products factory. One man running machine two hours per day supplies plant with sand, a job that formerly kept three men hauling sand 10 hours a day.

MAN-HOURS are vital these days. Every saving in labor on construction work is a direct contribution to the war effort. Sauerman Power Drag Scrapers and Slackline Cableways are chosen for excavating and stockpiling on defense projects because this simple, sturdy equipment has a 30-year record as a conserver of energy in moving all kinds of earth and bulk materials.

Sauerman machines not only save labor; they also are easy on the bankroll. The first cost of a Sauerman machine for the average long haul job compares favorably with the cost of any other equipment that will dig, haul and place an equal yardage of materials. Moreover, power requirements are moderate and the machine demands little by way of repairs, assuring a small daily expense.

Write for Catalog

SAUERMAN BROS, Inc.
532 S. Clinton St. CHICAGO

tion for several days following the fl insured the safety of supply.

At Pierre, where the Missouri Ri reached the highest stage since 18 three wells supply the city. Two we completely surrounded by river wat but fortunately the third was on su ciently high ground so as not to be a fected by the river. By sharply reduci the rate of water consumption, the Pier waterworks officials maintained uninte rupted service from the one well duri the emergency period.

Flood waters covered the entire pum ing field containing six sand-point we at Cheyenne Agency. Several feet earth cover the wells which are pumpe through submerged suction lines te minating in a central pumphouse. Th pumphouse was kept in operation b throwing up an earthen dike around and dewatering the building with small portable pump.

Floodwaters reached a depth of severa feet on the outside of the raw wate pumphouse at Chamberlain. However doors and windows were barricaded an sealed permitting only a small amoun of seepage into the building. Thi water was easily removed by the raw water pump.

Water supply at Fort Thompson sus tained only a slight interruption whil raw water pumps were being moved to the roof of the pumphouse to escap the floodwaters.

Other towns and cities along th Missouri River experienced similar in conveniences from high water but al managed to meet the emergency and continue uninterrupted the supply o safe water.

• • •

Alleged labor racket victimized contractors

One of the largest alleged labor rackets affecting the construction industry was brought to light on May 19 when Frank S. Hogan, district attorney for New York, obtained the surrender of Joseph S. Fay and James Bove, vice presidents of two labor unions, on indictments charging extortion and conspiracy to extort $703,00 from contractors recently employed in constructing the large tunnels for New York City's new Delaware water supply system. Mr. Fay is international vice president of the International Union of Operating Engineers (A.F.L.), and Mr. Bove is international vice president for the eastern region for the International Hod Carriers, Building and Common Laborers' Union (A.F.L.). Both men pleaded not guilty and were released on $25,000 bail.

The extortion is stated in the indict-

t to have begun in 1936 and to have
inued up to recent time, threats of
es, and curtailment of labor supply
g used to obtain the money.

he indictment contains the follow-
list of demands and collections al-
d to have been made by Fay and
e:

eaboard Construction Co., a combine
several contractors, $125,000 de-
ded, approximately $125,000 col-
ed.

tah Construction Co., another com-
, $129,000 demanded and collected.

ssociated Contractors, Inc., another
bine, $250,000 demanded and $150,-
collected.

Valsh Construction Corp., of Daven-
, Iowa, $125,000 demanded and
000 collected.

Perini Sons, Inc., of Boston, $50,000
anded and approximately $35,000
ected.

ew York Trap Rock Corp., 230 Park
., New York, $12,000 demanded and
000 collected.

F. Shea Co., of Los Angeles, and
Henry J. Kaiser Co., $109,000 de-
ded and $109,000 collected. (Mr.
ser is reported to have said, after the
ctment was made public, that his
pany had paid nothing.)

Iason & Hanger Co., of Lexington,
, $60,000 demanded and $36.000
ected.

eorge M. Brewster & Son, Inc., of
ota, N. J., $65,000 demanded and
000 collected.

• • •

hird pipeline to East nay be necessary

etroleum Administrator Ickes has
that it is "quite within the realm
possibility" that a third big pipeline
he East may be found necessary.

Ir. Ickes made the statement in a
er to Representative Snyder of Penn-
ania, chairman of the Army Appro-
tions Subcommittee, in opposing the
s-Florida barge canal project from
point of view of the wartime petro-
n situation.

Ir. Ickes said pipelines can be built
relatively brief period of time, that
use materials and power with greater
iency than any other carriers except
an tankers, and that they are econom-
to operate.

• • •

ig gains made in war ousing in two months

pproximately 92,000 publicly financed
using units for war workers were
ced under contract during the first

3H
"VAN DYKE" EBERHARD FABER U.S.A.
MICROTOMIC GRAPHITE

Free! A Sample Pencil
attach this coupon to your business letterhead

EBERHARD FABER PENCIL CO.
37 Greenpoint Ave., Brooklyn, N.Y.
Please send me a _____ degree MICROTOMIC "VAN DYKE" with HI-DENSITY Lead.
Name__________
Position__________
Business Address__________

For Tracings You'll be Proud to Initial!

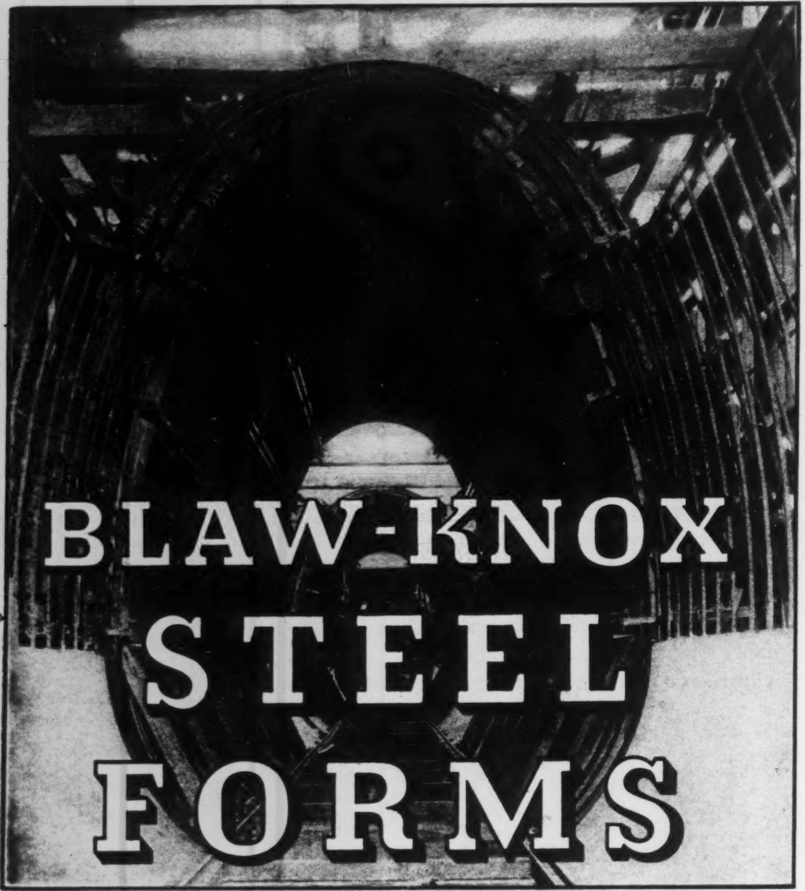
HI-DENSITY Lead will produce tracings of OPACITY beyond your previous experience—and clearer, sharper blueprints. Your drafting skill will immediately perceive the advantages of a MICROTOMIC VAN DYKE Drawing Pencil . . . and you'll delight in its smoothness, uniformity of grading and notably longer wearing qualities. We suggest you clip the coupon, and investigate HI-DENSITY Lead.

MICROTOMIC
VAN DYKE
DRAWING PENCILS

The Eberhard Faber Drawing Pencil with the MICROTOMIC Lead . . . 18 Degrees . . . and 6 also with Chisel Points.

HI-DENSITY LEAD

Utilize Blaw-Knox experience in job planning . . . .



Blaw-Knox form engineers have the "know-how" to help you plan a concrete construction job so that the work will be done in quick time and at the lowest possible cost.

This is a service which Blaw-Knox has given without charge to engineers and contractors for more than 36 years, resulting in the economical building of thousands of concrete projects, both large and small, with the use of Blaw-Knox Steel Forms.

Current construction work of a sufficiently urgent nature can now be served, and long range planning for the proper handling of future jobs can be aided by experienced Blaw-Knox engineers.

BLAW-KNOX STEEL FORMS are used for the construction of
TUNNELS WALLS SEWERS DAMS BRIDGES PIERS
CONDUITS ROADS SEWAGE DISPOSAL PLANTS . . .
. . . and other varieties of concrete construction

BLAW-KNOX DIVISION of Blaw-Knox Co.
2001 FARMERS BANK BUILDING PITTSBURGH, PA.
NEW YORK • CHICAGO • PHILADELPHIA • BIRMINGHAM • WASHINGTON

two months of the present year, Commissioner Herbert Emmerich of the Federal Public Housing Authority has announced.

This two-month record compared wit 90,000 units placed under contract during the final four months of 1942 an represented more than one-sixth of th total volume of publicly financed wa housing started since the beginning o the war housing emergency in the summer of 1940, of which about 273,00 units have been completed.

• • •

Labor-Management Talks Speed Ship Construction

An example of the advantage to ship production schedules that comes from frank discussion by joint committees representing labor and management is afforded in reports from the Wilmington yard of the California Shipbuilding Corp. where weekly meetings are held for discussions of this sort.

Every Monday six Calship executives and seven representatives of employees discuss such problems as elimination of lost man-hours, methods of increasing production, improvement of parking facilities, group insurance, selective service and deferments and the weighing of differences to avoid grievances.

Discussions usually conclude with consideration of "ideas" submitted by employees and the award of war bonds (ranging up to $100 value) to those turning in the best suggestions. During a seven-month period in which the offer of rewards for useful ideas has been effective, more than 3,000 labor-saving and safety improvement ideas have been considered by the judges.

• • •

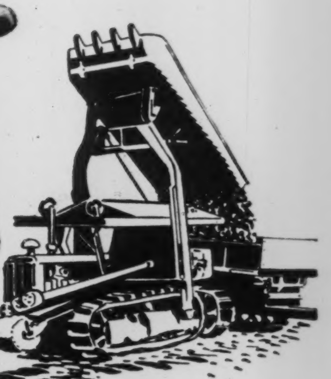
Record-breaking ship construction at Calship

Records tumbled as production soared during April at the Terminal Island yard of California Shipbuilding Corporation. Wilmington, Calif.

Two new world's records were set by Calship during the last month, as the firm delivered nineteen new 10,500-ton Liberty ships and boosted its total production to date to 173 Liberty ships delivered, 179 launched and 193 keels laid.

Both the monthly and total production figures surpass any other shipyard in the world producing ships of comparable

w, Improved ATHEY MOBILOADER



Athey MobiLoader digs its load—travels in reverse to the truck, trailer or fill—discharges the material overhead. Saves turning, saves time and money in its simple "straight-line" economy loading action.

HTER—SIMPLER—SPEEDS EVERY LOADING JOB TH "STRAIGHT-LINE" LOADING ACTION . . .

ATHEY MOBILOADERS . . . the new, time-saving method of loading materials . . . have been proved by hundreds of contractors, municipalities, mines and other owners during the past four years. Now, comes an improved Athey MobiLoader that operates on the 35 h.p. "Caterpillar" Diesel D4 Tractor. It has many advancements in design over its predecessor model, but retains those features which helped Athey MobiLoaders establish such outstanding records of speed and economy in loading.

The Model W4-1 is "streamlined" and greatly simplified . . . has lower center of gravity . . . increased stability . . . improved bucket design . . . reduced height, making it easier to transport from one job to the next. It digs, hauls and dumps its load in "straight-line" action . . . eliminates turning of tractor to discharge load.

MobiLoaders handle general excavating—or stockpile loading of gravel, rock, sand, coal, ore, earth or clay.

Send for the interesting folder showing a production chart on what the Model W4-1 will do. Write Athey Truss Wheel Co., 5631 W. 65th St., Chicago, Ill., for Form 604.

ECIFICATIONS

MODEL W4-1 MOBILOADER

CKET CAPACITY 1⅛ cubic yards

eight, approx. 6150 lbs.

umping Height 8 feet

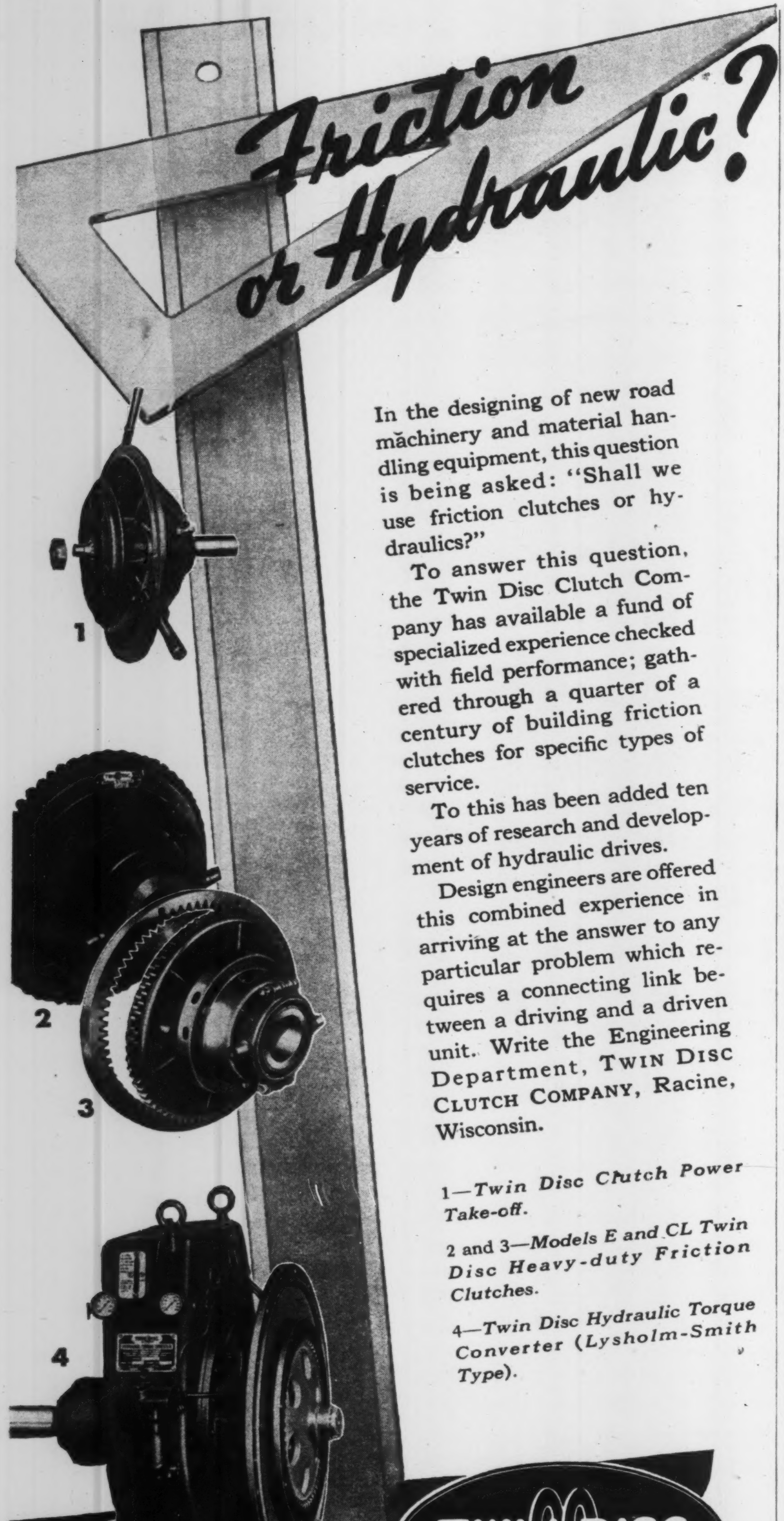
Overall Height, bucket lowered, 7'6"

Overall Height, bucket raised, 16'2"

Operates With "Caterpillar" Diesel D4 Tractor

★

ATHEY MOBILOADERS ★ ★ ★ ★ ★ TRAILERS



In the designing of new road machinery and material handling equipment, this question is being asked: "Shall we use friction clutches or hydraulics?"

To answer this question, the Twin Disc Clutch Company has available a fund of specialized experience checked with field performance; gathered through a quarter of a century of building friction clutches for specific types of service.

To this has been added ten years of research and development of hydraulic drives.

Design engineers are offered this combined experience in arriving at the answer to any particular problem which requires a connecting link between a driving and a driven unit. Write the Engineering Department, TWIN DISC CLUTCH COMPANY, Racine, Wisconsin.

1—Twin Disc Clutch Power Take-off.

2 and 3—Models E and CL Twin Disc Heavy-duty Friction Clutches.

4—Twin Disc Hydraulic Torque Converter (Lysholm-Smith Type).

size. During the last month Calship livered a completed 10,500-ton freig every 37.9 hours and launched eigh ships during the 30 days of April.

Indicative of the ever-increasing duction tempo at Calship is the ad fact that twice during April, the chopped a day from its own kee launch record, to reduce that time to days.

• • •

Chicago engineers honor 100-year old ship

The 100th anniversary of the laun ing of the first American naval ve built of iron, was observed last w in Chicago at a joint meeting of Western Society of Engineers, the Illi section of the American Society of C Engineers, and the Chicago Engine Club. The ship was launched in 1 as the U.S.S. Michigan, according Frank F. Fowle, consulting engineer, pointed out that the original iron h and engines are still in existence af 80 years active duty on the Great La and 20 years more of exposure to elements with no repairs and limi protection.

After serving as a training and s vey ship until 1905, her name w changed to the Wolverine, continued Fowle, because a new battleship w given the name of Michigan, and s continued in active service until disabl by an accident in 1923. In 1927 t ship was stricken from the Navy list a the following year she was towed to h present moorings in Misery Bay ne Perry's monument on Presque Isle. La year even her name was taken from h and given to a Great Lakes passeng liner now serving as a practice aircra carrier.

• • •

Mexico will build a "University City"

Plans for the construction of the U versity City in Mexico City by the N tional University of Mexico, a proje estimated to cost 20 million pesos ($ 150,000) has been advanced by the a pointment of a committee of enginee and architects to handle the propositio This committee consists of Ing. Ped Martinez Tornell, Subsecretary of Co munications and Public Works, an Bruno Mascanzoni, Francisco Jose A varez, Mauricio Campos, Roberto Alvar Espinosa, Francisco Centeno and Carl Contreras.

The National University of Mexico North America's oldest college, as was established in 1553.

CK FACTS ON SITE SEWER PIPE

STALLATION . . .

nsite's long lengths reduce number of joints needed in line . . . its light weight per- s easier, faster, more eco- nical handling.

FILTRATION . . .

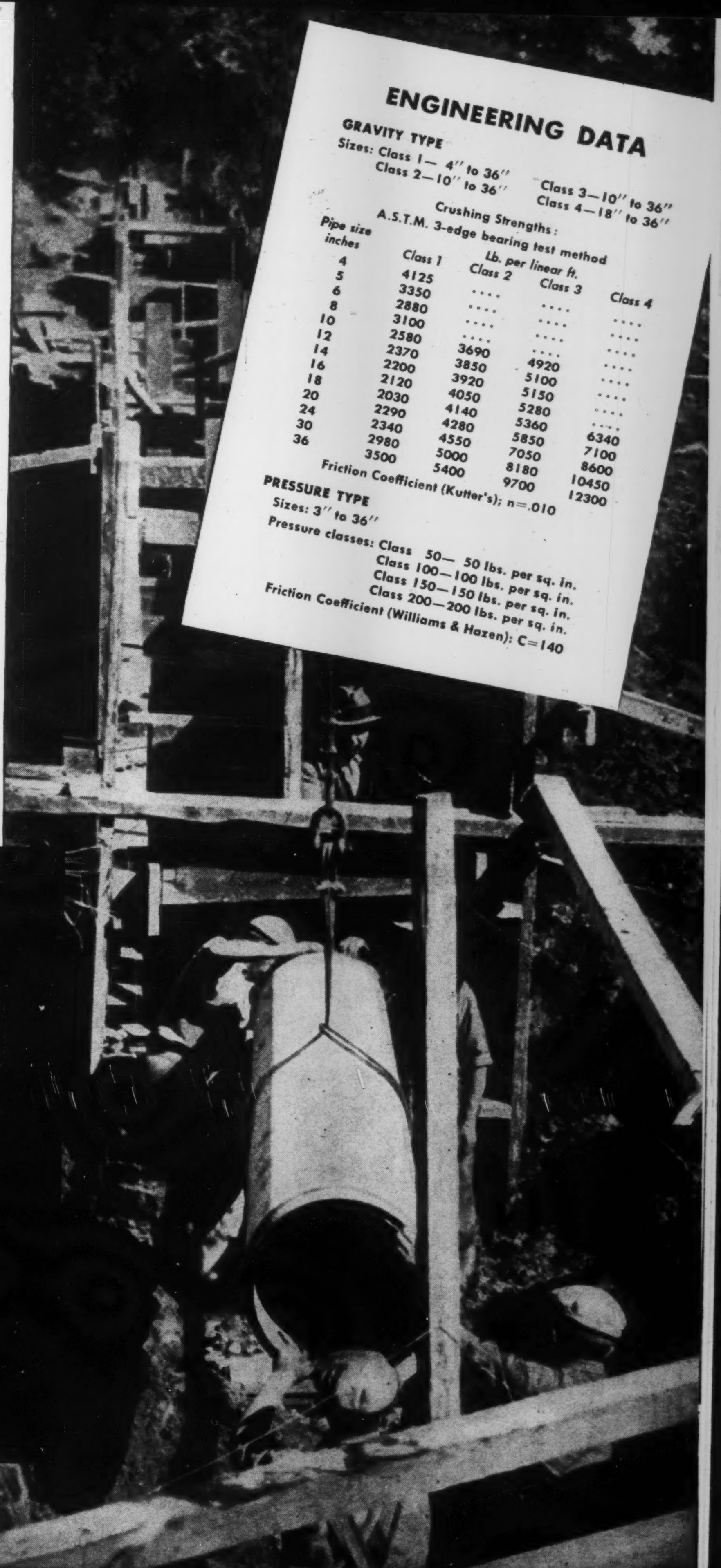
ver, tighter joints minimize kage, cutting down on the d at the disposal plant.

ELIVERY CAPACITY . . .

is advantage of Transite Pipe quently permits smaller pipe flatter grades, resulting in llower trenches.

BLE BOTH FOR FORCE AND GRAVITY LINES

mplete information is given brochure TR-21A. And for de- ls on lower-cost water trans- rtation, send for Transite ater Pipe Brochure TR-11A. hns-Manville, 22 East 40th reet, New York, N. Y.



ENGINEERING DATA

GRAVITY TYPE

Sizes: Class 1— 4″ to 36″
Class 2—10″ to 36″
Class 3—10″ to 36″
Class 4—18″ to 36″

Crushing Strengths:
A.S.T.M. 3-edge bearing test method
Lb. per linear ft.

Pipe size inches	Class 1	Class 2	Class 3	Class 4
4	4125	....	....	....
5	3350	....	....	....
6	2880	....	....	....
8	3100	....	....	....
10	2580	3690	4920	....
12	2370	3850	5100	....
14	2200	3920	5150	....
16	2120	4050	5280	....
18	2030	4140	5360	6340
20	2290	4280	5850	7100
24	2340	4550	7050	8600
30	2980	5000	8180	10450
36	3500	5400	9700	12300

Friction Coefficient (Kutter's); n=.010

PRESSURE TYPE

Sizes: 3″ to 36″

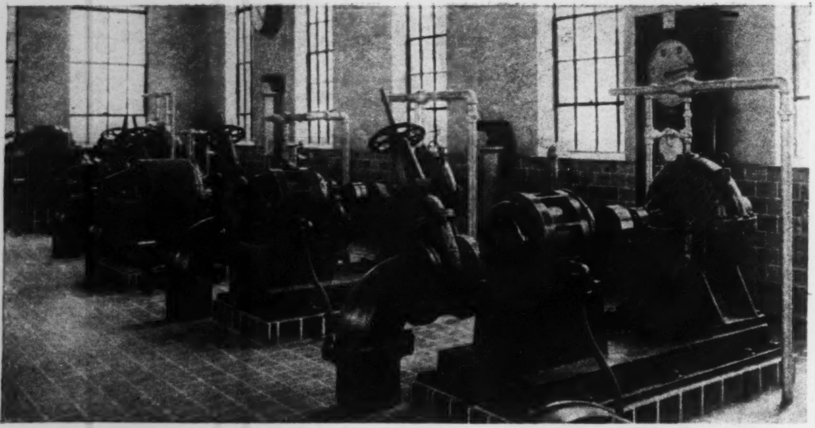
Pressure classes: Class 50— 50 lbs. per sq. in.
Class 100—100 lbs. per sq. in.
Class 150—150 lbs. per sq. in.
Class 200—200 lbs. per sq. in.

Friction Coefficient (Williams & Hazen): C=140

Johns-Manville

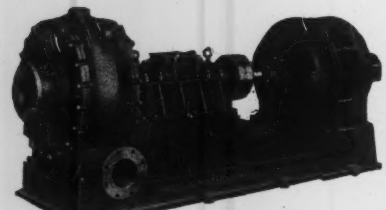
ANSITE SEWER PIPE

Asbestos Product

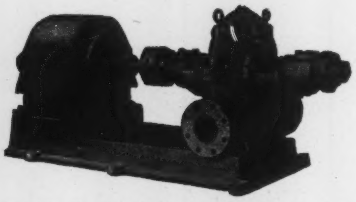


HOW TO SELECT LONG-LIVED PUMPS

There's an old . . . and well founded . . . medical saying that if you want to live long, pick out long-lived ancestors. On that basis alone, the Morris Pumps of today are assured of a long, useful life, for they have the same rugged constitution that has characterized their pump predecessors for more than two human generations. And in addition, the many refinements in design possessed by present-day Morris Pumps have produced remarkably high efficiencies that far exceed those which were formerly possible. Morris bulletins tell the whole story . . . write for copies on centrifugal pump types in which you are interested.



Heavy-Duty Material Handling Pump



Double Suction Horizontally Split Pump for Clear Liquids

MORRIS MACHINE WORKS

MORRIS

ESTABLISHED 1864

BALDWINSVILLE NEW YORK

CENTRIFUGAL PUMPS

BRIEF NEWS

The Colorado Association of Hi Contractors, Inc. has changed its to Colorado Contractors Association with offices at the same address, 30 Iron Building, Denver, Colo.

The engineering division of the versity of Louisville, Louisville, Speed Scientific School—has started struction of four dormitory buil 40x145 ft., two stories high, and a hall, one story, 40x110, for use of engineer training in a course re from four years to two years and months. The buildings will be of construction but of a semi-perma nature, on concrete foundations, erected so they can later be bric neered. The cost will be about $250 raised by city, county and public scription.

The county council of St. John, N has authorized a committee to town planning. The Dominion Go ment of Canada will allot postwar g for construction and reconstruction to cities and towns in which town ning has been officially adopted, money would be given only where structive building plans are availab

The Republic of El Salvador is ing considerable progress in the pro tion and improvement of the health its people, recent reports indicate. large public health program, launc last year, is being furthered by the tional government through supplem ing initial funds amounting to hal million dollars received from the Uni States. In addition to government penditures, municipalities are also propriating funds to aid in carrying the program.

With reference to the joint power velopments on the Ottawa River, to undertaken by the provinces of Onta and Quebec, there has been introdu into the federal House of Commons leg lation to cover the transfer of cert lands to the two provinces. These la are required for the power developme and are now under control of the fede government.

The Massachusetts legislative com tee is formulating a bill to be presen to the state senate with the object

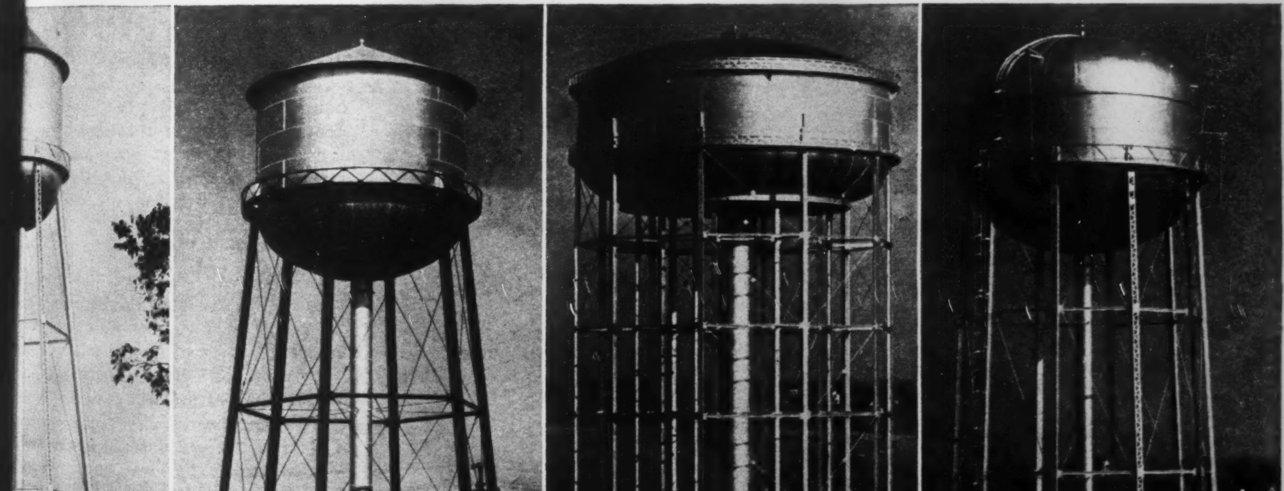
for the Duration—

USE THIS SIMPLE EQUIPMENT TO HELP ASSURE CONTINUED BEST SERVICE FROM YOUR

ELEVATED STEEL TANKS

by PITTSBURGH DES · MOINES

Keep its protective coating intact, and your elevated tank will last for many years! Now, more than ever before, the simple paint maintenance that gives maximum life to steel is a conservation duty for every municipality. To help in this necessity, we will gladly supply paint specifications for your local riggers and painters, and any needed advice as to procedure, without charge. Write!



PITTSBURGH · DES MOINES STEEL CO.

PITTSBURGH, PA. 3414 NEVILLE ISLAND—DES MOINES, IOWA, 915 TUTTLE STREET
NEW YORK, ROOM 916, 270 BROADWAY · CHICAGO, 1218 FIRST NATIONAL BANK BUILDING
DALLAS, 1219 PRAETORIAN BUILDING · SAN FRANCISCO, 621 RIALTO BUILDING
SEATTLE, 1122 EIGHTH AVENUE, SOUTH

The Pump

DESIGNED AND BUILT TO MEET TODAY'S DEMANDS

The new Economy SCV pump is adaptable to almost any pumping job where clear water or liquids are handled. Vertical in design—it saves space and places motor high and dry above its mounting surface. It is built with the stamina to do the job—no costly pump failures to disrupt schedules. For services from 10 to 500 G.P.M. with heads up to 225 Feet. Write for Catalog D2-1042 which fully describes and illustrates the SCV pump.

Free!

Economy's latest Pump Data Book. Contains a wealth of data and supplies information for the solution of most pumping problems. Written in simplified form—easily understood by anyone interested in pumps. Get your copy now—simply send your request on company's letterhead.

- Easy to install—low operating cost — minimum maintenance requirements.
- Complete rotor, including motor, can be removed without disturbing the suction and discharge connections.
- No costly shutdowns — in the event of motor failure any comparable stock motor is easily adapted.
- Impeller runs smoothly between two bearings—no shaft whip—no noise.

Economy Pumps Inc,

HAMILTON, OHIO

WYTEFACE "A"
TRADE MARK
STEEL TAPES

K&E
REG. U. S. PAT. OFF.

Easy-to-read, *raised* black graduations on crack-proof white surface ... resist abrasion from rock, sand, scraping over rails, pipe, concrete, etc. In all sizes and types—in cases or reels. Ask your dealer—or write for catalog.

I'LL TAKE THE WHITE ONE EVERY TIME!

STEVENS WYTEFACE "A"
KEUFFEL & ESSER CO.
INCH 2 3
GRADUATED IN INCHES OR TENTHS

EST. 1867
KEUFFEL & ESSER CO.
NEW YORK · HOBOKEN, N. J.
CHICAGO · ST. LOUIS · SAN FRANCISCO · LOS ANGELES · DETROIT · MONTREAL

obtaining a revised state-wide buil code. Backers of the proposition clude Harvard University and M chusetts Institute of Technology neers who believe it will produce l lation that will eliminate for all the perils of another holocaust suc that at the Cocoanut Grove night clu Boston a few months ago.

A modern steel and cable-suspen bridge to cost more than a million lars is being rushed to completion 300 to 400 men over river near Fort John, B. C., as a vital link in the Al Highway.

Legislation has been passed in bama calling for the replacement of State Bridge Corporation and the S Bridge Authority with a new Alaba Bridge Finance Corporation for refina ing at a lower rate of interest the proximately $4,300,000 of indebted of the agencies. The sponsors of legislation explain that outstanding bo now bearing 4 percent interest might refunded at about 1¼ percent wit saving over a ten year period of ab $750,000.

Because of heavy storms, engineers the three Kaiser shipyards near P land, Ore., a few weeks ago were for to build cofferdams around the sterns ships on their shipways to hold back rising freshet waters of the Colum and Willamette Rivers. It was only that way that keel layings and work the lower portions of hulls could c tinue. Smaller shipyards of the Portla area did not attempt to hold back water; they simply postponed laun ings and underwater installations un the freshet passed.

C. R. Young, dean of the faculty Applied Science and Engineering of t University of Toronto, was awarded honorary degree of doctor of engineeri by Stevens Institute of Technology at annual commencement exercises recent Dean Young has taught at the Universi of Toronto for the past 30 years and h been dean of the engineering facul since 1941. He is past president of t Engineering Institute of Canada.

Governor Rexford G. Tugwell h signed a law appropriating the sum $100,000 for the activities of the Po Rico Planning, Zoning and Urbaniz Board. Part of this appropriation will devoted to postwar planning and co struction.

ly a man, a maul and a wrench

B IN ONE-HALF THE TIME!

• It's true. It's proved. It's a fact. Using Dardelet *Rivet-Bolts,* steel structures can be assembled *in less than half the time* required for a hot riveted job. No air compressor for the air hammer. No rivet heating forge. No "bucker-up". The Dardelet *Rivet-Bolt* with its patented thread produces full rivet strength of the structural assembly—with a man and a maul and a wrench.

Man-power shortages suggest serious consideration of such facts as these, developed in the course of actual field experience and time studies, viz: *four men* drove and fastened 750 ⅞-inch Dardelet *Rivet-Bolts* in an 8-hour shift, whereas a four-man crew could install only 400 hot-driven rivets in the *same* period of time!

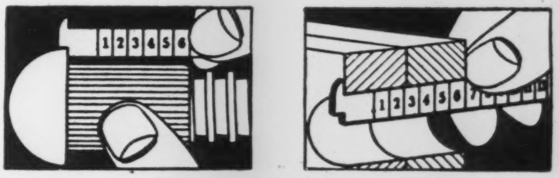
An increase such as this in quantity of *Rivet-Bolts* applied as against hot-driven rivets is usual, not the exception, and it takes less time to train a man to drive *Rivet-Bolts* than it does to teach a crew to drive hot rivets. Whether assembling steel members of a building or for any other large riveted structure, Dardelet *Rivet-Bolts* provide an advantage of time saving which, in wartime construction, is a vital consideration.

Moreover, and this is extremely important—

(1) Dardelet *Rivet-Bolts* permit quick alterations, remodeling, additions and complete dismantling of riveted structures.

(2) Dardelet *Rivet-Bolts* need but one man to install them although one man driving *Rivet-Bolts* and one man applying nuts speeds up the job nearly 100%.

Applying Dardelet *Rivet-Bolts* is simple. Drive the *Rivet-Bolt* into the drilled or punched hole, and the deep splines flatten to make a body-bound fit. Nut spins freely on the bolt until it seats, then tightening it with a wrench brings into power the famous Dardelet Thread-Lock. Until purposely backed off with a wrench, the nut cannot loosen on the bolt. (See illustrations at bottom on opposite page entitled "left, above" and "right, above.")



How to apply the Dardelet River-Bolt:

1. Using common fitting up bolts, pull connections up tight as for field riveting.
2. Align all holes with FULL SIZE drift pins. Badly misaligned holes should be reamed.
3. Use "RIVET-BOLT" Grip Number Gage to check depth of hole and length of bolt.
4. Insert "RIVET-BOLT" in hole and drive home with maul.
5. Tighten nut with ironworker's open-end wrench or socket wrench.

BOLTS, NUTS & SCREWS
LAMSON
SIMPLIFIED STOCK LIST

These four books will help you in specifying and buying "standard" bolts, nuts and "specials"

THE LAMSON BLUE BOOK—is our complete Catalog of standard products excepting our Aircraft products.

"BOLTS, NUTS & SCREWS"—70 pages of technical and practical information. First copy gratis, requested on your letterhead. Additional copies one dollar each.

"BOLT, NUT & RIVET STANDARDS"—175-page book published by the American Bolt, Nut & Rivet Manufacturers Association, 1550 Hanna Building, Cleveland, Ohio. Price one dollar per copy. (Order from publishers, please.)

"SIMPLIFIED STOCK LIST"—of bolts, nuts and screws, conforming to latest revisions of the Office of Price Administration, and of great value in showing you in what ratio quantities of various standard products are kept in stock for deliveries, by your jobbers and in our own (and other bolt manufacturers') warehouse stocks.

THE LAMSON & SESSIONS COMPANY
General Offices, 1971 West 85th Street • Cleveland, Ohio

AMSON & SESSIONS

LTS · · NUTS · · COTTERS · · CAP SCREWS · · SPECIALS

Your Jobber Stocks the Lamson Line

FOUNDATIONS

We offer

STEEL PILES
TENSION PILES
CAISSON PILES
BUTTON BOTTOM PILES
COMPOSITE PILES
WOODEN, STEEL OR CONCRETE SHEET PILES
COMPRESSED CONCRETE PILES

DRILLED-IN CAISSONS

Engineers available for consultation on any foundation problems Catalogues on request.

WESTERN
WESTERN FOUNDATION CO.
WESTERN CONCRETE PILE CORP.

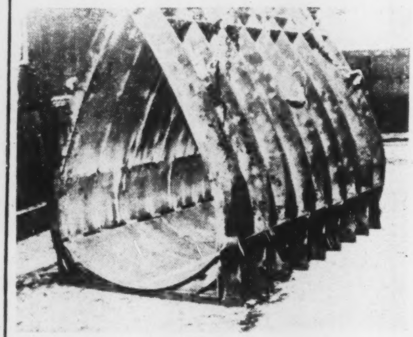
308 W. Washington St.
Chicago, Ill.

52 Vanderbilt Ave.
New York, N. Y.

NEW AIDS TO THE CONSTRUCTOR

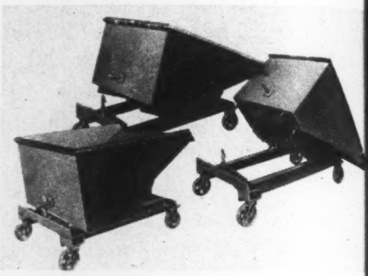
Fluorescent Lamp Starter

An average rated life of three years has been announced for a fluorescent lamp starter. The mechanical features which prolong the life of the starter also help to conserve the life of the lamp, and saves power consumption and maintenance service. These mechanical features are (1) precision lamp starting. The starter is timed to light the lamp at the right instant. This conserves emmissive material essential to long lamp life and it also prolongs the life of the starter. (2) Dead lamp lockout. Close tolerances in the starter's mechanism make possible a quick and positive performance in the lockout of dead lamps, eliminating blinking and flickering when a lamp burns out. When a dead lamp is removed, the apparatus is reset simply by pressing a button on top of the starter. The new lamp is then inserted and is brought into the circuit immediately.—*General Electric Co., Bridgeport, Conn.*



Arc Welded Die

Where formerly machining and bolting construction would have been used, a large die has been made entirely by arc welding. The die, approximately 8 ft. long, 6 ft. wide and 6 ft. high, was built for deforming 78 in. corrugated round pipe into an arch with flat bottom, straight sides and a round top. The illustration shows the arc welded die. Requiring only 40 hr. for layout work and 60 hr. for welding, it is estimated that b burning and welding instead of machining and bolting, between 40 and 50 per cent saving was effected.—*The Hobar Brothers Co., Troy, Ohio.*

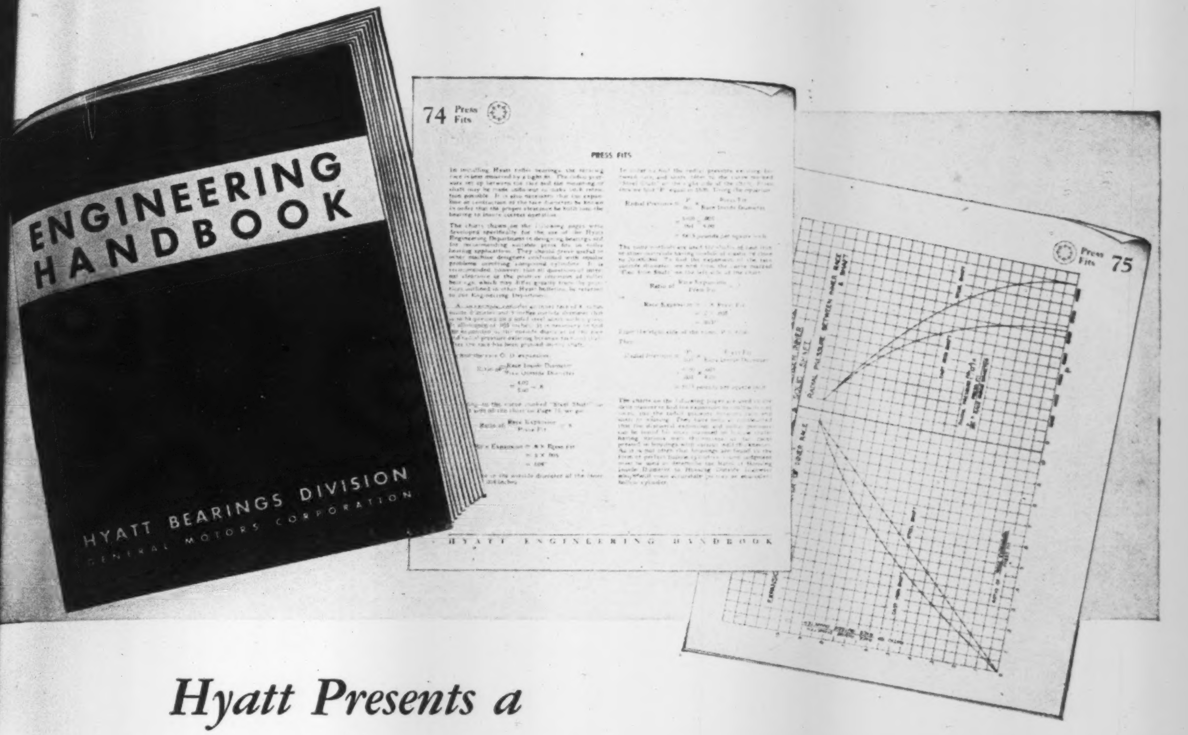


Automatic Dump Hopper

A new model automatic end dump hopper on casters is now available. When the latch is released and the load is dumped, the bucket is so balanced that it automatically returns and latches in position when reloaded. It rides empty in the balanced position; mounted on heavy duty all steel casters it is an adaptable unit for the handling of sand, gravel, coal, stampings, small castings and all kinds of scrap and refuse. It is built of structural steel and heavy plate, and is designed to fit any kind of lift truck but may be built to specifications as to capacity and yardage content.—*Rose Mfg. Co., 12400 Strathmoor, Detroit, Mich.*

Rechargeable Flashlight Battery

The limitation on the production of dry cell flashlights lends interest to a new rechargeable storage battery for flashlights. This type of cell is used for industrial and utility service and is said to have proved its value wherever flashlights are required. Although small in size, it has been used in actual heavy duty service and found dependable, long-lived and economical according to the manufacturer. Each battery can replace up to 400 or more dry cells. This is possible by recharging at convenient periods.


ENGINEERING HANDBOOK
HYATT BEARINGS DIVISION
GENERAL MOTORS CORPORATION
74 Press Fits
PRESS FITS
Press Fits 75
HYATT ENGINEERING HANDBOOK

Hyatt Presents a

TIME-SAVING, WORK-SAVING SERVICE

for Engineers and Designers of War Products

Just as Hyatt Roller Bearings are helping to speed up Victory in war equipment and in the machines that produce it, now the new Hyatt Engineering Handbook is in the fight.

It's a quick-reference manual... sort of a "scrap book" collection of fundamental engineering data such as you might assemble yourself, from various sources, to obviate the necessity of poring through numerous books to find certain formulae or data.

In addition, it contains much new material which eliminates lengthy calculations. For example, in the 10-page section on Press Fits, charts are used to determine the expansion and contraction of compound cylinders and the radial pressure existing between them. Desired information can be read directly from the charts.

A limited edition of this new 96-page Roller Bearing Engineering Handbook is now being distributed to leading engineers and designers throughout the country. A request on your company letterhead, stating your position, will bring you a copy with our compliments. Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey

HYATT ROLLER BEARINGS

Another New Bridge with
Operating Machinery by...
EARLE

Earle operating machinery on vertical and rolling lift, bascule and ferry transfer bridges . . . on sewage disposal works, locks, dams and dredges, has long service records on installations throughout the United States and abroad.

Send for the Earle booklet 42-B. It illustrates and describes a number of Earle bridge operating machinery installations.

THE EARLE GEAR & MACHINE CO.
4717 Stenton Avenue, Philadelphia, Pa.

Lift Span Bridge
designed by
WADDELL & HARDESTY
★
THE PHOENIX BRIDGE CO., INC.
General Contractors

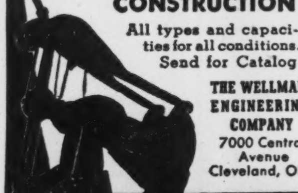
EARLE GEARS

For "the duration" our boat-building facilities are 100% government. Our foundation and dredging facilities are still available for commercial use.

BULKHEADS
PILEDRIVING
WHARF CONSTRUCTION
DELAWARE BAY
SHIPBUILDING CO., INC.
LEESBURG, NEW JERSEY

WILLIAMS *Buckets*

WELDED ROLLED STEEL CONSTRUCTION



All types and capacities for all conditions. Send for Catalog.

THE WELLMAN ENGINEERING COMPANY
7000 Central Avenue
Cleveland, Ohio

built by
WELLMAN

Battery chargers are available for t purpose, both in single and gang typ for use on both alternating current a direct current.—*The Ideal Commuta Dresser Co., 1368 Park Ave., Sycamo Ill.*

Outdoor Photoelectric Relay

A new general-purpose photoelectr relay for outdoor use has been announce It is for applications requiring rapid an accurate counting, controlling, sortin or limiting operations. The relay weatherproof case is equipped with sun shield and a large, directional le system to minimize the effect of slanti sun rays. In addition, the lens syste increases the relay's sensitivity. The r lay can be mounted in any position an can be adjusted under actual operatin conditions, without removing the cove The chassis can be removed easily fro the case for inspection or servicing o if desired, for mounting with other ap paratus in a combination enclosure.— *General Electric Co., Schenectady, N.*

Arc Welders

With a view to expanding its weldin equipment service, this corporation ha announced the addition of a complet line of alternating current arc welders Engineered and built for heavy dut service, these machines are being mad in seven heavy duty and four intermitten duty models with a range of capaciti for handling production welding un der continuous operation.—*Harnischfeg Corp., Milwaukee, Wis.*

Tandem Power Rheostats

Compact, sturdy tandem power rheo stat assemblies of two or more section are now available. These assemblies ar made up of two 25-watt or two 50-wat

Saving of 20%
AMER. MUT.

Copyright 1943 by American Mutual Liability Insurance Company

Here's the Cream in Your Contract

Thousands of contractors count on an extra profit when they insure their jobs with American Mutual

In figuring estimates, insurance st is an important item. And it is e item where American Mutual licyholders feel they have an adntage. For they have always reived from American Mutual regular vidends amounting to 20% or more premium costs.

In fact, American Mutual's dividend cord is unbroken since 1887—a recd unequalled by any other American bility insurance company.

Responsible in part for the fact at such large savings can be made, e services which help to reduce sses. These services also provide e individual policyholder with sh savings over and above the divind. Accident prevention services, r example, directed by American utual consultants specializing in nstruction work, help avoid the many losses in time, material and money which result from accidents. And favorable accident experience leads to reduction in premium costs.

Another American Mutual service is the careful planning of coverages. Again, American Mutual's long experience in the construction industry is valuable, for trained underwriters can help determine the simplest, least expensive means of providing adequate protection for the different requirements of each new job.

Let American Mutual — the firm which specializes in your type of work — help you plan your protection . . . take advantage of the regular dividend opportunity (the "cream in your contract") and other cost-reducing services. The free booklet "Our Savings Are Your Profits" will tell you more about the advantages of placing with American Mutual your workmen's compensation, contractors' public liability, automobile, fidelity bond and other coverages. Write Dept. O24, 142 Berkeley St., Boston, Mass.

American Mutual Liability Insurance Company

AMERICAN MUTUAL
WORKS FOR YOUR SAFETY

Admitted Assets	$56,020,555.08
Liabilities	48,020,239.44
Surplus to Policyholders	8,000,315.64

As of December 31, 1942

TOOL HOSPITAL
NO. 1 LEFT
NO. 1 RIGHT
MADE BY H.K. PORTER INC.
BOSTON
HKP
HKP
Let's not worry about thumb prints —this belongs in your shop
E

Recovery Complete

The scarcity of new tools for civilian use grows increasingly acute. The only answer to this emergency shortage is to properly care for the tools we have and to repair potentially useful tools that have been discarded. Millions of dollars worth lie rusting in cellars, workshops and factories. Most of these could be put back to work for a fraction of their original cost. Most of these tools are of good quality and are simply the victims of carelessness or abuse. To put them into good working condition would cost on the average not more than one-fourth of their original cost. Repair parts are available. In many cases, no parts are needed or by combining parts from several tools a completed working tool will result.

Efficient, workmanlike tools are vital weapons of defense on the home front. Let's put our discarded tools back to work, while we can. We are going to need them desperately. Neglect now means deprivement later.

H. K. PORTER, INC., manufacturers of metal cutting tools since 1880, offer a practical booklet on the use, maintenance and repair of Porter HKP Cutters and other types of small tools. Send for your copy now. All Porter tools are precision built and like parts are interchangeable.

Army-Navy "E" awarded to our Men and Women for Excellence in War Production.

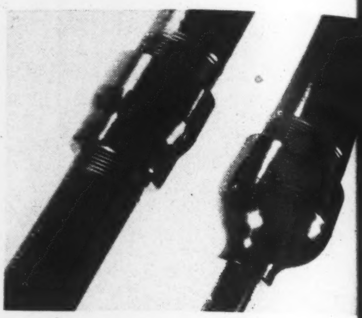
H. K. PORTER, INC.
408 Ashland St., Everett, Mass.

Without cost or obligation send me your booklet on the use, maintenance and repair of Porter HKP Cutters.

NAME................................

ADDRESS................................

rheostats rigidly coupled together a held in a metal cradle. The usual on hole mounting and locking-projecti features are retained. The individu rheostats can be of any standard resi ance value, taper, tap and hop-off, a all units go through the same degree rotation as the single shaft is turne The units are fully insulated from ea other and from the ground. Because the wide choice of resistance values a other factors, the manufacturer stat that such assemblies are necessarily ma only on special order.—*Clarostat Mf Co., Inc., 285-7 North Sixth St., Broo lyn, N. Y.*



Plastic Pipe and Tubing

At present the need for metal pip tubing is many times what it would b in peace-time. This indicates that th only solution to the problem is the utili zation of new working materials that ar able to fulfill the requirements of th trade. One practical solution to a por tion of the problem is said to be offere through the development of new plasti pipe and tubing. Much research, develop mental work, and testing under actua operating conditions have gone into th manufacture of a new plastic pipe, tub ing, and the required fittings. This ther moplastic pipe and tubing possesses th ability to fulfill many operating demand made on metal pipe. In addition, a num ber of valuable properties enable it to meet the requirements of unusual appli cations where metal piping could no qualify. In appearance, it greatly re sembles metal pipe, being a smooth round, black material with dimension conforming to standard heavy iron pip specifications. It is only one-quarter th weight of iron pipe, which makes a fea ture of considerable value in the solution of suspension, installation and shipping problems.—*Dow Chemical Co., Midland Mich.*

Plastic Nozzles

Plastic nozzles, strong, durable and light, are replacing critical metals as an essential of fire-fighting equipment. New plastic nozzles, precision-molded, possess distinct advantages. They are corrosion-

hile he's fighting for your future . . . .
are you planning for his?

better water will make your city a better place to live

WHEN your fighting men come home, will they find it a better place to live in? Good water by Permutit will help ake it so. Good water—free of hardness, dirt, color and other npurities—means happier, healthier homes, more prosperous hops and industries.

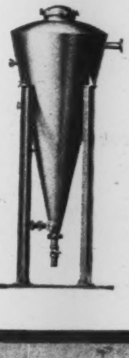
Right now Permutit* equipment is conditioning the water r thousands of war plants and for Army camps and Naval ases. After the war it will be available for every city. Be eady for this public improvement—plan it now! Write for deails to The Permutit Company, Dept. A12, 330 West 42nd treet, New York, N. Y. In Canada: Permutit Company of anada, Ltd.... Montreal...Toronto...Winnipeg...Calgary.

*Trademark Reg. U. S. Pat. Off.

PERMUTIT

WATER CONDITIONING HEADQUARTERS

SOFT, CLEAR WATER IN ONLY 8 MINUTES!



Permutit's recently developed "Spiractor" equipment is revolutionizing cold lime soda water softening. It cuts detention time as short as 8 minutes. There is no sludge. It's simple to operate. And it makes big savings in space—an installation with a daily capacity of 1,000,000 gallons measures only ten feet at its widest point!

...on the INDUSTRIAL FRONT

WITH PLYMOUTH

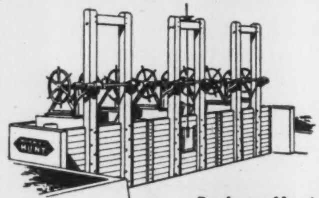
THE man at the throttle today is Uncle Sam. He needs production! He wants maximum efficiency in handling the materials of War! That's where Plymouth enters! Plymouth Locomotives provide peak performance on all types of work, in all kinds of weather.

Ruggedly built . . . extremely efficient . . . low first cost . . . low operating cost . . . minimum maintenance . . . speed and versatility . . . Plymouth guarantees dependability on the drive to Victory! Plan your production with Plymouth Gasoline or Diesel powered locomotives. Available in accordance with the war production planning of our government.

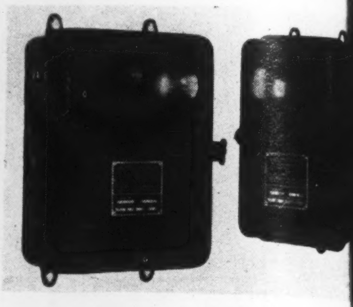
TRACK HAULAGE is CHEAPER HAULAGE

PLYMOUTH GASOLINE and DIESEL LOCOMOTIVES
PLYMOUTH LOCOMOTIVE WORKS
Division of The Fate-Root-Heath Co. PLYMOUTH, OHIO, U. S. A.

THE MOUNT VERNON
BRIDGE CO.
Engineers Contractors
STRUCTURAL STEEL
RAILWAY AND HIGHWAY
BRIDGES
BUILDINGS AND VIADUCTS
MOUNT VERNON, OHIO


Rodney Hunt
SLUICE GATES
Are you interested in metal or timber sluice gates? Also hoists, stands or other water controlling apparatus? Rodney Hunt has over 100 years' experience making this type of equipment.
Write for special catalog today.
RODNEY HUNT MACHINE COMPANY
79 Lake St. Orange, Mass., U. S. A.

proof, non-denting, highly resistant acid and alkalis, liquids and water c tent. They hold their shape perfec and are good for practically lifel service, according to the manufactu Nozzles are furnished with standard h sizes of fire extinguishers and tanks t are pressure-operated by stirrup pum etc.—*American Molded Products C 1751 No. Honore St., Chicago, Ill.*



Photoelectric Protection

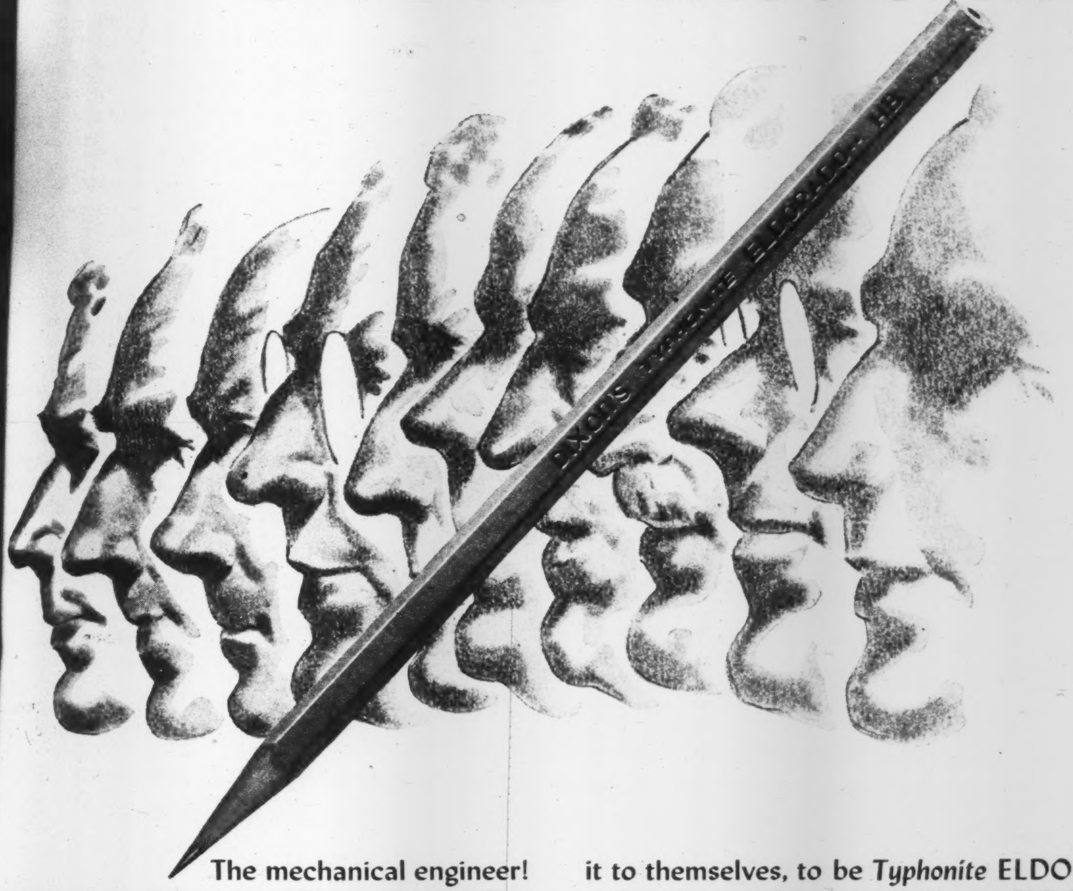
A new photoelectric protection syste projects a fence of invisible light ov distances as great as 1,500 ft. and giv instant local or central-station alarm an intruder enters the protected are Designed to meet government requir ments, it is claimed that the equipme has an operating range longer than th of any other photoelectric system so f developed. It is especially suited to th protection of harbors, shipyards, dock industrial properties, airports and sim lar large areas. Because the apparatu responds only to the frequency of lig emitted from the light source, it is n affected by other artificial light or b daylight.—*Photoswitch Inc., 77 Broad way, Cambridge, Mass.*

Maintenance Cost Sheets

To all users of rock drills the manu facturer offers free of charge a supply o printed sheets to aid in recording repai and maintenance costs. These sheet make it possible to show accurately th upkeep cost of every drill in service also such pertinent data as the dri number, class, model, manufacture names and numbers of new parts in stalled, cost of installing parts, numbe of shifts the drill works, etc.

The size of the sheets is 8½x11 in They are designed to fit in any standar file and are punched for use in standar 3-ring binders. The scarcity of critica metals now makes it imperative to main tain rock drills properly and to avoi practices that cause abnormal wear o parts. It is felt that a careful record o drill maintenance will assist in suc conservation. — *Ingersoll-Rand Co., 11 Broadway, New York, N. Y.*

TEN MEN FROM MISSOURI!



The mechanical engineer! he aeronautical designer! The architect! The rt director! The civil engineer! The draftsman! he electronic engineer! The electrical engi-eer! The drafting instructor! The industrial esigner! These men had to be shown efore they'd admit which was the est drawing pencil. They are proving it to themselves, to be *Typhonite* ELDORADO.

Based on performance *Typhonite* ELDORADO pencils win. Typhonite leads are dustless, uniform, stronger. The blueprints of victory pour from the points of reliable Typhonite Eldorados.

Pencil Sales Dept. 227-J6
Joseph Dixon Crucible Company
Jersey City, N. J.

TYPHONITE

ELDORADO

• Built in
completely assembled
units . . . quickly set up
in the field.

Portable Asphalt Plant

Assembled in Hours

THE
"Brass Brain"
(FLUIDOMETER)
This automatic metering system saves time, materials — insures uniformity. For all types of plants.

By "portable" we mean that this Model PA asphalt mixing plant is not only easily disassembled and moved from one job to another by truck or rail, but it can be quickly set up because units are entirely self-contained and require no field assembly. This means a big saving in assembly time—hours instead of days. The portable features of this plant are obtained without sacrificing either plant capacity, operating efficiency or durability. . . . Hetherington & Berner, America's oldest builder of asphalt mixing plants, offers the newest developments in both stationary and portable plant design. Write for Bulletin EN-260.

HETHERINGTON & BERNER Inc.
INDIANAPOLIS • INDIANA

Hetherington & Berner

BELMONT IRON WORKS
PHILADELPHIA ROYERSFORD EDDYSTONE

Fabricators *Contractors*
Exporters

STRUCTURAL STEEL
BUILDING & BRIDGES
RIVETED—ARC WELDED
BELMONT INTERLOCKING CHANNEL FLOOR

Main Office Philadelphia, Pa.
44 Whitehall St. New York Office

The PHOENIX BRIDGE CO.

BRIDGES and BUILDINGS

General Office and Works
Phoenixville, Pa.
District Offices
New York, N.Y. Boston, Mass.
Washington, D. C.

Tool Grinders

A new tool grinding principle whic is said may revolutionize the grinding carbide cutting tools by making unne sary the employment of highly skil labor for this work has been develo cooperatively by the Carboloy Co. the Edison Hotpoint General Elect Co. The secret of the superior qual of finish obtained on the tools is said be that the grinding wheel in addition rotating, also oscillates while the tool held stationary at the correct angle. T oscillation is in the plane of the whe This oscillation also contributes to speed with which the tools can be grou The machine eliminates the human e ment in correctly manipulating a t and applying correct pressure against wheel.—*The Carboloy Co., Inc., Detr Mich. and the Edison ("Hotpoint") G eral Electric Co., Chicago, Ill.*

Blue Welding Glass

An improved welding glass, blue color, that allows better vision than t usual green glass for aluminum a bronze welding, glass working, et where sodium yellow glare is present, announced. This glass was develop for reducing sodium yellow glare onl Standard green glass is still used f acetylene and electric arc welding.-*Wilson Products, Inc., Reading, Pa.*

Gearmotors

A new line of horizontal parallel sha type gearmotors which meet speed r duction requirements for a wide variet of industrial applications over a rang of 1 to 75 hp. is announced.

The use of adaptor castings betwee motor and mechanical parts allows th use of all standard Westinghous N.E.M.A. frame motors with each typ of unit, and types of motor constructio can therefore be readily changed to sui varying service conditions if necessary i the field. The design of the moto adaptor assembly being common uni types, such assembly can be readil shifted between unit types to mee changes in speed requirements. Many working parts including gear sets ar common to all three unit types of given rating, thus replacement part necessities are held to a minimum.

Gears and pinions in the new Gearmotors are of .40-.50 carbon steel, and are given special heat treatment before hobbing. This process produces a tapering hardness from surface to core, and results in tough, impact-resisting teeth. Gears and bearings are lubricated by a positive splash system, and new case design allows oil to circulate freely at all times.—*Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.*

MARION'S FIRST INTEREST IS TO WIN THIS WAR

BILL OF RIGHTS
ARTICLE I
Freedom of Speech
Congress shall make no law respecting an establishment of religion, or prohibiting the free exercise thereof; or abridging the freedom of speech, or of the press; or the right of the people peaceably to assemble, and to petition the Government for a redress of grievances.
ARTICLE II
Right to Bear Arms
A well regulated Militia, being necessary to the security of a free State, the right of the people to keep and bear Arms, shall not be infringed.
ARTICLE III
Quartering of Soldiers
MARION

What the Bill of Rights means to our fighting men is summed up in recent victories in every theatre of war. What it means to MARION is reflected in the continuous stream of Marion machines rolling off the assembly lines — the ever-increasing production schedules—the extra speed, stamina and dependability Marion engineers are building into these machines — the remarkable records of performance wherever they are employed. This is Marion's answer to those who would destroy our Bill of Rights — Marion's way of helping to win the war as quickly as possible.

THE MARION STEAM SHOVEL CO., Marion, Ohio

FOR VICTORY BUY UNITED STATES WAR BONDS AND STAMPS

MARION

SHOVELS • DRAGLINES • CLAMSHELLS
CRANES • PORTAL CRANES • WALKERS

WORKING FOR VICTORY: DIGGING—Coal • Magnesium • Iron Ore • Copper Ore • Bauxite • Manganese • Nickel Molybdenum • Sand and Gravel • Clay. MATERIAL HANDLING—Shipbuilding and Cargo Loading. BUILDING—Airports • Ordnance Plants • Army Camps • Marine Bases, etc.

HERE'S THE "KNOW HOW" YOU NEED FOR YOUR TUNNELING PROJECTS

COMMERCIAL
"BUILT-FOR-THE-JOB" LINER PLATES

Note the tunnel project shown here . . . consider the different techniques employed. The large circular shaft, with its regular shaped plates, and the smaller tunnel, with its egg-shaped plates, were completed speedily—efficiently—without bracing. Another instance where COMMERCIAL provided safe working conditions . . . speeded the work . . . saved money.

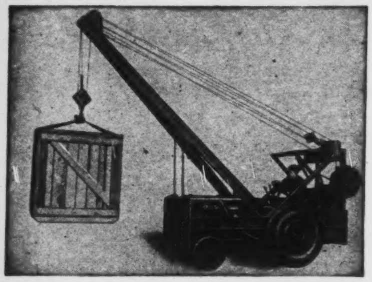
What COMMERCIAL Liner Plates have done for others, they can do for you. Get the full story today . . . write for estimates and specifications on COMMERCIAL Liner Plates as applied to your next tunneling project.

THE COMMERCIAL SHEARING & STAMPING CO.
YOUNGSTOWN OHIO

MERCER
"THE NAME THAT CARRIES WEIGHT"

WAR-PRODUCTION HANDLING EQUIPMENT
GANTRY AND WHEEL-TRACTOR CRANES
TRAILER TRUCKS
LIFT TRUCKS
CARTS
ELEVATORS
CONVEYORS

Illustrated, informative literature is available on all Mercer material handling equipment. State your problem. Our engineers will make recommendations for a prompt and practical solution.



Shown above . . . Mercer Crane fitted with pneumatic tires. Models so equipped travel over any kind of surface; do their job with speed and efficiency. An example of Mercer designing and Mercer construction. Our complete engineering facilities are at your service!

MERCER ENGINEERING WORKS, INC.
30 CHURCH STREET, NEW YORK—Works: CLIFTON (ALLWOOD), N.J.

MANUFACTURERS' ACTIVITIES

Lawrence W. Wallace, vice presid of the Trundle Engineering Co., Cleveland, Ohio, was given an honorary degree of doctor of engineering by the Agricultural & Mechanical College of Texas at recent commencement exercises. The degree, conferred in recognition of Mr. Wallace's outstanding c tribution to engineering science and the cause of engineering education is t second which he has received, havi been given the honorary degree of doct of engineering by Purdue University 1932.

A. C. Berg has been made manager the Gar Wood Road Machinery Divisi of the Gar Wood Industries, Inc., D troit, Mich.

Hugh A. Wallace has been appointe district engineer for the Asphalt Institu for the territory comprising Texas, Oklahoma, and Arkansas, with an office in the Southwestern Life Building, Dallas, Tex. Mr. Wallace's engineering experience for the past 20 years covers service in the Texas State Highway Department and the Southwester division of the U. S. Engineers. In th highway department he started as a assistant engineer on highway locatio and construction in west Texas, later serving as assistant resident engineer i Dickens and Baylor counties, maintenance superintendent in the Lubbock district, and for the past ten years i the maintenance division at Austin. His work there included general supervision of force account construction for the entire state.

Selection by Columbia University of Dr. Willard Henry Dow, president of the Dow Chemical Co., as the Chandler lec-

New WHITE SURFACE MAKES PENCIL LINES OPAQUE

White-X drawings are *easy on the eyes* because the ultra-transparent velvety white surface has exactly the right tooth to get the most out of hard pencils. You get jet black lines—*opaque* lines. Yet White-X erases easily without ghosts—its high gloss back repels dust and it's moisture resistant *both* sides. Glass-like transparency makes drawings print *etching*-sharp. White-X has cloth durability—it's a *pleasure* to work on—and to print from. That is why it is one of today's most popular new Post products.

The Frederick Post Co.

Phone KEYSTONE 7000 · CHICAGO

POST

FOR IMMEDIATE DELIVERY

Fine tracing media and sensitized papers ready for delivery from the following cities. Just phone

Atlanta-**JACK. 2121**
Birmingham-**3-8183**
Boston-**LIBERTY 4690**
Buffalo-**CLEVE. 0370**
Chicago-**KEY. 7000**
Cincinnati-**MAIN 2664**
Cleveland-**CHE. 7347**
Columbus-**MAIN 3420**
Dallas-**RIVERSIDE 4403**
Dayton-**ADAMS 9174**
Denver-**MAIN 5161**
Detroit-**RAN. 8483**
Ft. Wayne-**ANT'Y 4142**
Fort Worth-**3-3244**
Hollywd-**GRANITE 4188**
Houston-**CAPITOL 1233**
Indianapolis-**MKT. 4466**
Jacksonville-**5-2166**
Kans. City-**VICTR 7881**
Knoxville-**3-4944**
Los Angeles-**MUT. 2341**
Memphis-**8-6796**
Milwaukee-**MARQ. 7246**
New Orleans-**RAY. 0331**
New York-**WIS. 7-7670**
Oklahoma City-**3-6306**
Omaha-**ATLANTIC 7890**
Philadelphia-**LOM. 7044**
Pittsburgh-**ATL. 3350**
Portland-**ATWATER 8681**
St. Louis-**CHESTNUT 0688**
Salt Lake City-**4-7823**
San Diego-**FRANKLIN 1344**
San Francisco-**DOU. 5975**
Seattle-**MAIN 4022**
Tampa-**M-8377**
Toledo-**ADAMS 7224**
Tulsa-**3-0168**
Washington-**NATL. 4063**
Wichita-**2-2722**

or by mail or phone to our Chicago office.

Both PULLING FOR VICTORY

INVEST IN VICTORY . . . BUY WAR BONDS AND STAMPS

and P.M. Service

Keeps 'Em Both Rolling

Uncle Sam has become America's largest truck fleet owner. His olive drab vehicles are operating at every Army Camp at home and on every battle front abroad. Like other leading fleet owners, he quickly saw the advantages of GMC Preventive Maintenance Service . . . quickly adopted it in a great many of his motor maintenance units. Your war working trucks are every bit as essential to victory as their military brothers, perhaps even more so, because they must serve out the war with little chance of replacement. They need the *best* Preventive Maintenance that money can buy so that they will perform economically and dependably for the *most* number of miles.

Special "Service Payment Plan" available through our own YMAC

See your GMC dealer first for a new truck—National inventory plan makes a wide choice available

Pledged U.S. TRUCK CONSERVATION CORPS

GMC VICTORY MAINTENANCE KEEPS YOUR TRUCK ON THE JOB

THE TRUCK OF VALUE

GMC TRUCKS

GASOLINE • DIESEL

turer and medalist for 1943, throws spotlight of the chemical world on 46-year-old native of Midland, Mich. citation accompanying the award na Dr. Dow as one of the outstanding in trialists of the present generation noted as particularly spectacular achievements of the company in pro ing bromine and magnesium from water and of synthetic plastics rubber.

Having pioneered the fabrication steatite insulation and of high-freque iron cores from highly compressed p dered materials, Henry L. Crowley & Inc., West Orange, N. J., now announ the extension of its activities to c pacted metal fabrication of intric shapes and sizes. The process beg with fine metallic powders, compres in dies under tremendous pressures i given shapes and sizes, followed by tering to convert such pieces into so metal masses. Gears, cams, bearin either simple or intricate, are thus tainable without the usual time-consu ing and costly machining operations.

Thomas F. Hanley has been appointed general manager of the Dowty Equipment Corp., Long Island City and Sunnyside, N. Y., producers of hydraulic aircraft equipment. Mr. Hanley is also treasurer and director of the Dowty company.

Fred W. Deutsch has been reelected t the Board of Directors and as vice-presi dent of the Everson Mfg. Co., 214 W Huron St., Chicago, Ill. Mr. Deutsch' entire business career since leaving th Stevens Institute of Technology has bee connected in one way or another with th water treatment field.

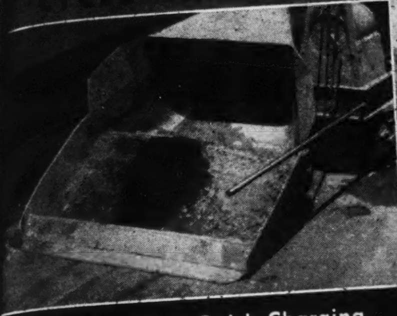
Election of G. Donald Spackman a vice president in charge of operations o Lukens Steel Co., Coatsville, Pa., has been announced by Robert W. Wolcott, president. Mr. Spackman has been general manager of Lukens and its subsidiaries since January 1941.

A process patent for water purification by a special coagulation aid has been granted to Chester L. Baker and Charles H. Dedrick and assigned to the Philadelphia Quartz Co. The patent covers a method for preparing a special solution

BATCH-CYCLE SPEED

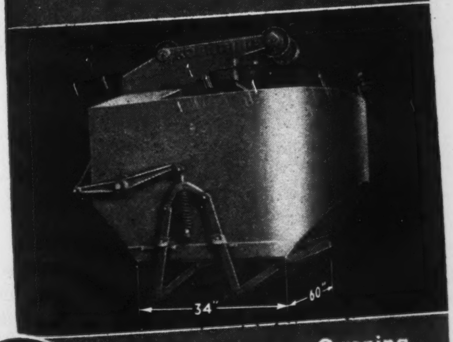
CUTS POURING TIME

THESE 3 OPERATIONS REDUCE BATCH-CYCLE TIME . . .



Wide, Flow-Line, Quick Charging Skip Saves Seconds.

Air Controlled Discharge Chute is Positive, Quick Acting.



Twin-Door, Large Opening Bucket Dumps and Spreads at High Speed.

MAXIMUM YARDAGE KEEPS JOB MOVING . . . Concrete slab jobs, today . . . airports, military highways and access roads . . . must be poured at top speed . . . men, equipment and materials . . . all striving to one end . . . smooth concrete highways and runways . . . in the shortest possible time. Koehring Paver batch-cycle speed helps meet production schedules. Batch-cycle is controlled by three important operations . . . charging, discharge and spreading. Koehring skip charges drum at high speed . . . drum interior quickly shrinks material . . . twin-door bucket spreads concrete without clogging delay. All operations are accurately and automatically batch-meter timed for maximum production.

KOEHRING COMPANY, ***Milwaukee, Wis.***

KOEHRING HEAVY DUTY

HEAVY-DUTY CONSTRUCTION EQUIPMENT

THIS IS THE TOUGHEST TEST

YOUR exacting circular reinforcement jobs go easier and faster, because Clinton Fabric is made UNIFORM in tensile strength of wire and in welding. You are assured of maximum strength and higher performance standards. To get this uniformity every step is supervised by experts in our own plant, from open hearth to wire drawing to welding. The fabric comes in sheets or rolls cut to your *exact* job specifications, saving your time and expense.

CLINTON
Electrically Welded
REINFORCING FABRIC

WICKWIRE SPENCER STEEL COMPANY
500 Fifth Avenue New York, N. Y.

IF YOU USE
WHEELS or AXLES
YOU NEED OUR ENGINEERING EXPERIENCE!

WE have cooperated closely with Industry for more than 50 years—producing millions of dependable, efficient steel wheels and axles; each specifically suited to its task. The knowledge gained through all this experience is available to you *now*—to help you get the utmost service and satisfaction from your "rolling stock". Write today for complete Illustrated Bulletins.

EWC WHEELS
Electric Wheel Co., Dept. NR, Quincy, Ill.

of sodium silicate and a metal salt, wh mixture is introduced to raw metal pr to the addition of the coagulant. This agulation aid is for the purpose of ducing a more rapid formation of lar floc, thus removing a higher percenta of the suspended impurities. The silica metal salt method has already been us in several water purification plants.

M. W. HEINRITZ, of Trenton, N. J., been named vice-president in charge of the storage battery division of the Philco Corp. Mr. Heinritz, who joined Philco in 1922, was born in Clinton, Mass. During the first World War he served in the signal corps and then returned to the Worcester Polytechnic stitute from which he was graduated 1920.

N. R. KNOX, vice president of the Bu rus-Erie Co., Milwaukee, Wis., who h been with the firm since 1920, has be elected president. D. W. W. Colma who had been president for the last 32 years, remains as chairman of the board. Mr. Knox, who is 44 years old, started as a worker in the foundry and after being graduated from Harvard he rose rapidly to night foreman, electric furnace smelter, assistant foundr superintendent, general superintenden works manager, assistant to the vic president, and vice-president. George A Morrison was advanced from vice-presi dent to vice-chairman of the board. W. L Little, works manager of the Erie, Pa plant, was named vice-president, an W. M. Bager, formerly vice president has been made technical director. N. A McGrath continues as secretary an J. G. Miller as president.

TO MAKE THE EMPLOYEES feel that the are a vital part of the war program, th Marmon-Herrington Co. of Indianapolis Ind., has substituted bugle calls fo whistles at change of shifts and at mea time. The plant streets and thorough fares have been designated with patriotic names. The program was started wit ceremonies conducted by a detachment of soldiers from nearby Fort Benjamin Harrison.

Quality Paving Asphalts

PREFERRED
IN PEACE-TIME
IMPERATIVE
IN WARTIME

Lion Asphalts Still Meet
Your High Pre-War Specifications

For 20 years quality asphalts as developed and demanded by asphalt technologists and engineers have made pavements that last longer, thereby conserving materials and manpower. It is well to remember that it's the asphalt that holds the pavement together; if the binder fails, the life of the pavement is shortened and upkeep costs are high. Superior resistance to deterioration has built an enviable reputation for Lion asphalts.

6 Reasons Why
Lion Asphalts Assure Permanent, Economical and Successful Paving Jobs

1. Negative Oliensis Spot Test
2. High Specific Gravity
3. High Fluidity Factor
4. High Ductility at Low Temperatures
5. Low Susceptibility Factor
6. Uniformity

28

LION OIL REFINING COMPANY
EL DORADO, ARKANSAS

LION
PETROLEUM PRODUCTS

This is What "NATIONAL" Does for you
A CLEANED MAIN
Swept Away!
LOW PRESSURE
HIGH OPERATING COSTS
BAD HEALTH
REDUCED FLOW

WHEN YOUR

CLOGGED MAINS ARE MADE GOOD AS NEW

BEFORE CLEANING
AFTER CLEANING

Stop! Don't even *plan* to buy new pumps or larger mains . . . until you see "National" about it. Let us tell you how we make your old pipes practically good as new by the National method of water main cleaning. Get increased pressure and flow, lower operating costs, improved health conditions, greater fire protection.

Send for illustrated booklet with actual *facts from the field* and see how and why "National" will save you money. Write us today.

THERE IS NO SUBSTITUTE FOR EXPERIENCE

THE NATIONAL METHOD
BEFORE CLEANING
AFTER CLEANING

34 YEARS OF SUCCESSFUL WATER MAIN CLEANING

NATIONAL WATER MAIN CLEANING CO.

30 Church St. **New York, N. Y.**

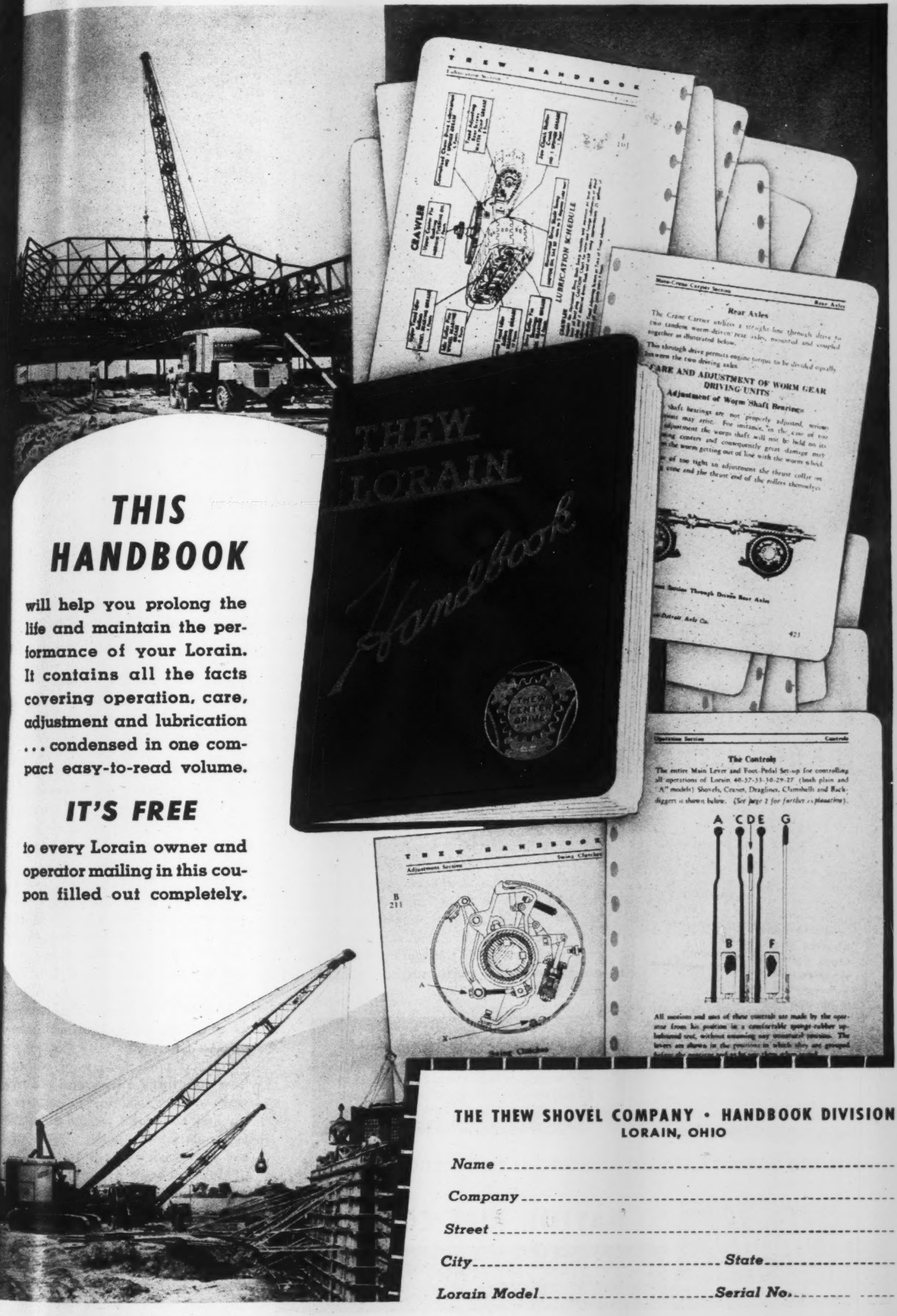
NEW TRADE PUBLICATIONS

Remote Control—The growing u
flexible joints has increased the de
for new and better designs of re
mechanical controls and shaft asseml
A new book covering problems of re
control, universal joints, shaft jo
couplings, hangers, assemblies, h
joints, universal joints, shaft expan
couplings, operating gears, engine
trols, steering controls, valve cont
ventilation controls, (manual), has
been released. This book provides c
plete descriptions of two entirely
joints—the consolidated hinge joint
positive and effective operating rang
angles up to 92 deg. in any one g
plane and the universal joint with p
tive and effective operating range
angles up to 360 deg. in any plane. Al
with the descriptions are data sheets
blueprints of the joints themselves
the brackets, expansion couplings,
semblies, shaft hangers, accessories
for their installations.—*Brooks Eq
ment Corp., 90 West St., New York, N*

Lubricating Cables—A wire cabl
actually a complicated group of
bearings. Its life depends on lubricat
A cable is not just a ropelike group
wires. It is a machine. Inside it ar
certain definite number of steel stran
bound together in a unity which le
strength but actually keeping a cert
ability to act independently. Each str
may move within certain close limits
when those strands move, friction
tension take their toll. How to lubric
cables to preserve their life and use
ness is explained in a handy boo
issued as part of the cable conservat
campaign.—*Keystone Lubricating C
21st, Clearfield and Lippincott Sts., Ph
adelphia, Pa.*

Earth Moving Costs—An 8 page c
ored booklet thoroughly illustrates h
Caterpillar tractors can be kept in c
dition and prolong their usefulness.
describes complete shop service, rapid
pair aid, dealer help in job planning,
of factory instruction books, servi
charts and other pamphlets on operati
tire and parts conservation, training
green operators and many other subjec
—*R. G. LeTourneau, Inc., Peoria, Ill.*

Measuring Instruments—A new c
densed catalog has been issued givi


THEW HANDBOOK
CRAWLER
LUBRICATION SCHEDULE
Rear Axles
CARE AND ADJUSTMENT OF WORM GEAR DRIVING UNITS
Adjustment of Worm Shaft Bearings
THEW LORAIN Handbook
THEW CENTER DRIVE
THEW HANDBOOK
Adjustment Section
Swing Clutches
Operation Section
Controls
The Controls
A C D E G
B F

THIS HANDBOOK

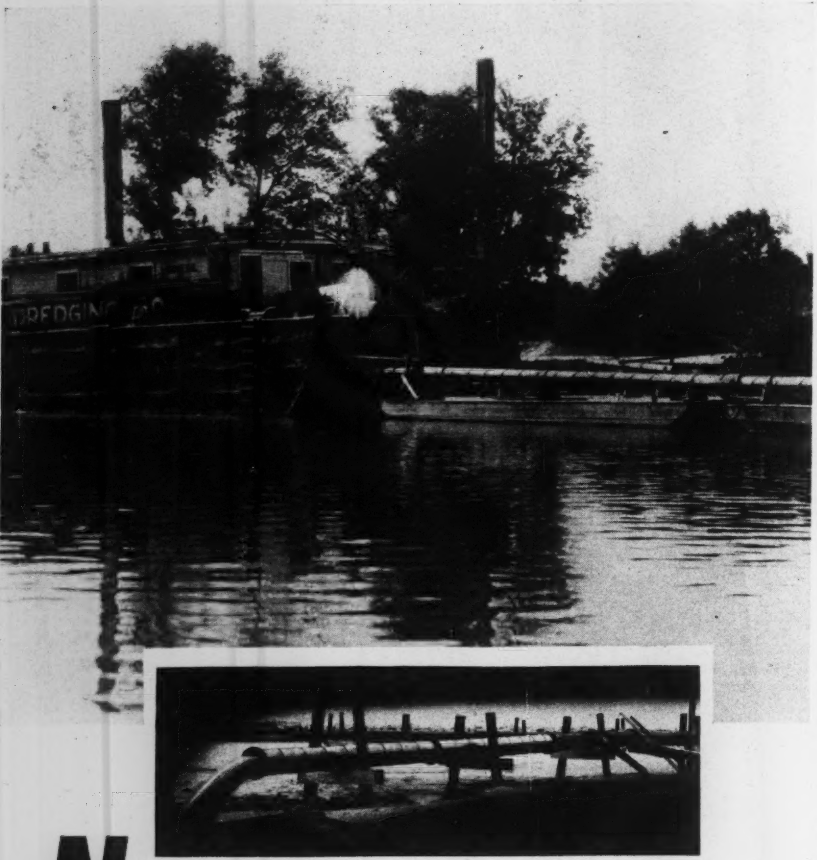
will help you prolong the life and maintain the performance of your Lorain. It contains all the facts covering operation, care, adjustment and lubrication . . . condensed in one compact easy-to-read volume.

IT'S FREE

to every Lorain owner and operator mailing in this coupon filled out completely.

THE THEW SHOVEL COMPANY • HANDBOOK DIVISION
LORAIN, OHIO

Name ____________________________
Company ____________________________
Street ____________________________
City ____________________ State ____________
Lorain Model ____________________ Serial No. ____________



NAYLOR LIGHT-WEIGHT PIPE MAKES LIGHT WORK OF DREDGING

NAYLOR PLUS PERFORMANCE

- Light weight saves steel.
- Accurate in diameter.
- Concentric ends match correctly.
- Holds true cylindrical form.
- Easier to handle and install.
- Absorbs shock loads.
- Stays tight and leakproof.
- Handles jobs normally requiring heavier-wall pipe.
- Cuts maintenance.
- High re-use value.
- Connections to fit your exact needs.
- Saves money.
- Sizes from 4" to 30" in diameter. Special connections and fittings for dredging service.

Naylor Pipe is made to order for dredging operations—combining the economies of light weight with structural strength, leak-tightness and safety. Experienced operators know that Naylor's exclusive Lockseam Spiralweld enables this pipe to carry loads usually requiring heavier wall pipe. It is ideal for high or low pressure service. This versatile service plus the savings in transportation and handling provide a most practical solution to your dredging problems.

NAYLOR PIPE SERVICE

Dredging . . Hydraulic Sluicing . . De-Watering . . Ventilating . . Exhaust and Intake . . Gas Gathering . . Pulp Lines . . Vacuum Lines . . and other high or low pressure lines

WRITE FOR NAYLOR CATALOG AND SPECIAL CONNECTIONS BULLETIN

Naylor

NAYLOR PIPE COMPANY

1248 East 92nd Street, Chicago, Illinois

current prices and short descripti this company's measuring and co ing instruments including pressur trollers, tachometers, remote contr resistance thermometer indicatin cording and resistance thermomete a great variety of other technical ments.—*Wheelco Instruments Co., rison and Peoria Sts., Chicago, Ill*

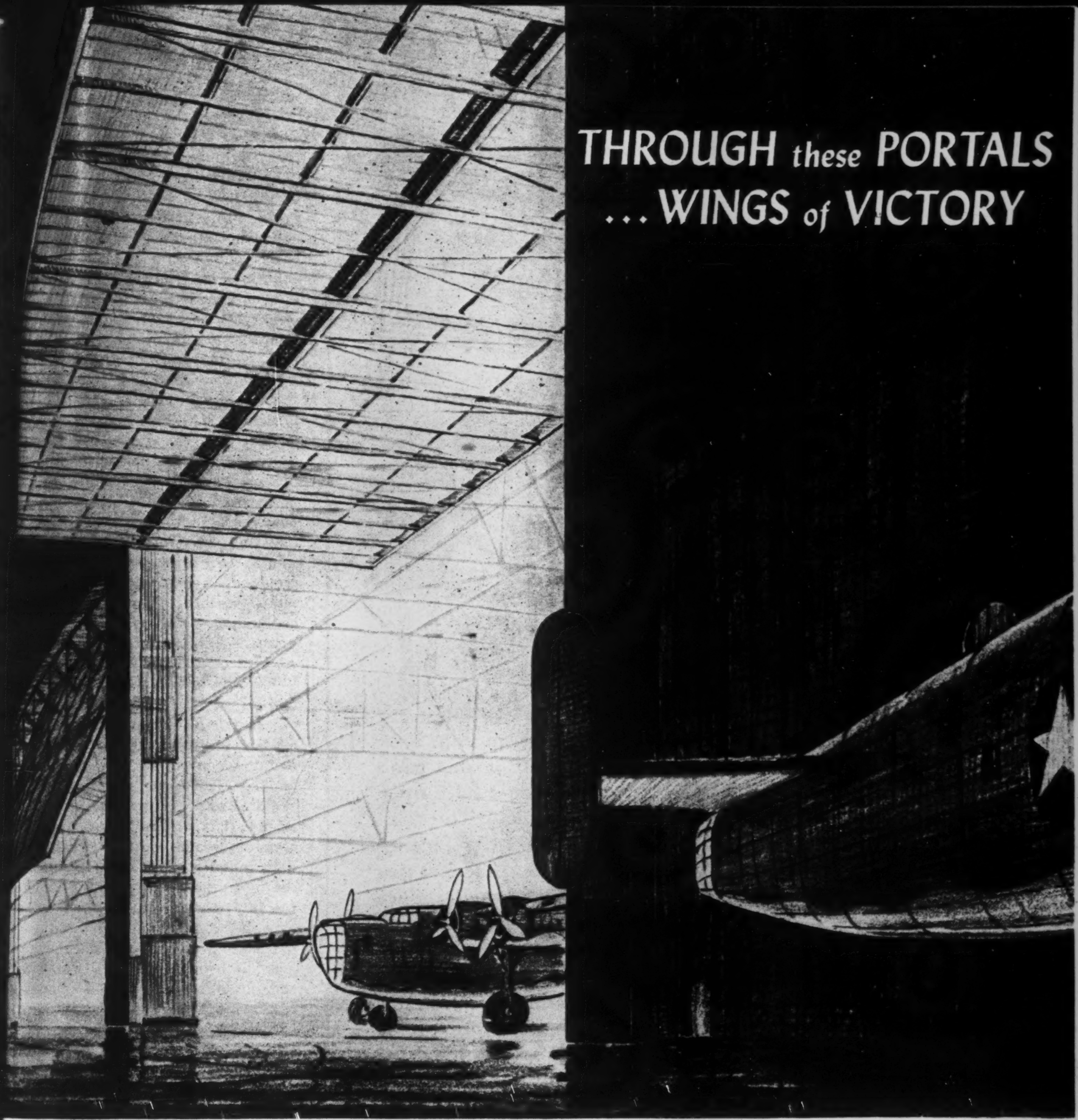
Wood Preservation—The growi cessity for wood preservation timely this 8 page illustrated br which is directed toward constr of heavy laminated beams and arc well as manufacturers of sash door wood and other wood products. plains the complete series of low wood treatments for plant applic Among these are water-repellant preservatives to meet the requireme the National Door Manufacturers ciation and the Western Pine As tion. The booklet describes metho treatment for protecting wood from ture and fungi decay, with a cha the back page showing methods of cation and needs for different typ preservatives, including water repe toxic and toxic water-repellent solu The contents of this book seem espe desirable at this time when wood placing metal in so many fields.— *Laucks, Inc., Seattle, Wash.*

Gas Pumps—A bulletin has been i —6 pages in color—containing ma lustrations showing various types of ing arrangements which make pumps readily adaptable to a wide of applications. Advantages in cons tion claimed by the manufacture discussed at some length together sectional views emphasizing the va features which are stressed. Dia shows volume and power characteri at constant and variable speeds.—*R Connersville Blower Corp., Conners Ind.*

Technical Data—A new revised li standard specifications for seamless t and pipe, arranged in handy finge form, is available to those who writ their company letterhead and give title.—*The Babcock & Wilcox Tube 85 Liberty St., New York, N. Y.*

Industrial Posters—This manufact of air compressors and compressed operated tools has issued a new serie industrial posters to wage war on le hose couplings, valves and other pipe tings and by so doing to help speed duction and avoid wasted power. Don two colors, the posters make gene use of splash illustrations. Five pos of the series are available with other preparation.—*Ingersoll-Rand Co., Broadway, New York, N. Y.*

Water Treatment—Mechanical dea tion, as applied to boiler feed wate the removal of dissolved gases such oxygen, carbon dioxide and ammonia the process of raising the water to



Wings of Victory ... the war planes that meet and beat the enemy ... are groomed in modification centers to the exacting, special requirements of our many different battle fronts.

To maintain a steady flow of aircraft, the modifying processes must function efficiently night and day, in any weather. Hangar doors must play their important part with speed and reliability.

Byrne steel Canopy Doors, 15-year veterans of the aviation industry, are being installed at the Bechtel-McCone-Parsons Corporation modification center.

BRANCHES:
WASHINGTON, 1082 Nat. Press Bldg.
SAN FRANCISCO, Builders Exchange
NEW YORK, 101 Park Avenue

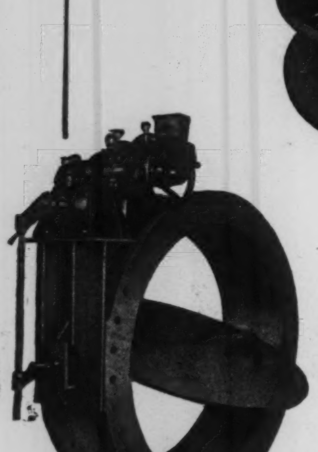
BYRNE doors
incorporated
1150 Griswold Street Detroit, Mich.

Cable Address: BYRNDOR
•
See our Catalog in SWEET'S

Easy to Operate...

Streamlined for Self-Cleaning

16-inch cast iron chain wheel operated valve for pressures up to 15 pounds. Complete range of sizes from 2-inches to 84-inches.



Automatic electric-motor operated American Standard Valve with hand wheel for manual operation in case of current failure. Available in 125 lb iron, 150 to 900 lb steel.

The action of an R-S Butterfly Valve is rapid and smooth. Four to six revolutions of the hand wheel or chain wheel fully open or close the valve vane. The compact, inherently narrow face-to-face dimensions, and the fact that there is no long stem or gate well, reduce clearance requirements to the minimum.

There is free passage for direct flow with no restrictions other than the streamlined vane. Sediment cannot collect since there are no right angle bends or reverse turns. Hence, the R-S Valve is ideal for the control and shut-off of dirty gas, dirty water, pulverized fuel or similar flowing solids.

The beveled vane wedges tight against the valve body for shut-off duty.

Write for catalog and detailed information about the use of R-S metals for resistance against heat, abrasion and corrosion.

R-S
QUALITY PRODUCTS SINCE 1908

15 to 900 psi

VALVE DIVISION
R-S PRODUCTS CORPORATION
116 Berkley Street Philadelphia, Penna.

R-S Streamlined BUTTERFLY VALVES

saturation temperature for the pres under which the process is conduct employing an equipment design that cures intimate mixture of the water the scrubbing steam, and provid means for the liberal venting from system of the gases released. These po and many others are discussed in a entific manner in an article entitled "U Processes of Water Treatment." Thi the leading article in *The Betz Indica* a monthly house organ published in interests of pure water.—*W. H. & L. Betz, Gillingham and Worth Sts., Fra ford, Philadelphia, Pa.*

Paving Products—A 12-page cata presents a listing of the various produ designed to the specifications and quirements of the paving industry. Th designs have all been tested by lead engineers. The subjects covered in booklet include mastic board, longit inal and transverse tongue and gro joints; fibre expansion joints; p moulded asphalt expansion joints; phalt sealing compound, sewer jo compound and expansion joint prices.—*Keystone Asphalt Products C 43 East Ohio St., Chicago, Ill.*

Welding and Cutting Handbook—A helpful step in instructing users of oxy-acetylene welding and cutting pr ess how to prolong the life of their equi ment, a convenient 20-page pocket s booklet entitled "Handbook for Welding and Cutting Operator" has be issued. It is written in an easy to und stand style and contains a list of conci do's and don'ts for the man who wiel the blowpipe and a wealth of other hel ful information and suggestions on care and maintenance of blowpipes, re ulators and welding and cutting accesso ies. The booklet may be obtained in re sonable quantities without charge fro any manufacturer of oxygen, acetylen carbide or welding and cutting apparat and supplies.—*International Acetyle Association, 30 East 42nd St., New Yor N. Y.*

Iron Waterproofing — A broadsid called a "Datalogue" explains the iro method of waterproofing in detail. It said to be the most powerful treatme yet developed for waterproofing concret cement plaster, brick, cement block, ti and all other masonry. It is also used fo walls and floors, new or old, above o below grade. It is applied by brush t inside or outside surfaces.—*The Eucli Chemical Co., 6205 Carnegie Ave., Cleve land, Ohio.*

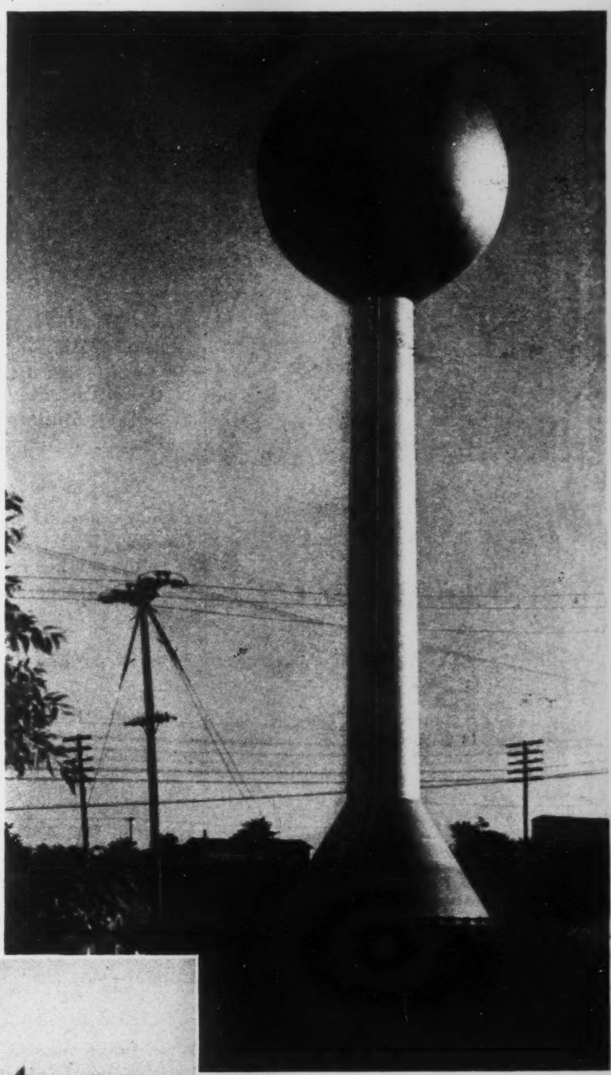
Roller Bearings—Hyatt Rollergravur put out by this manufacturer describe the use of roller bearings around th world. It is really a communique fro the front showing some of the hundred of ways in which these bearings ar working for victory.—*Hyatt Bearing Di vision, General Motors Corp., Harrison N. J.*

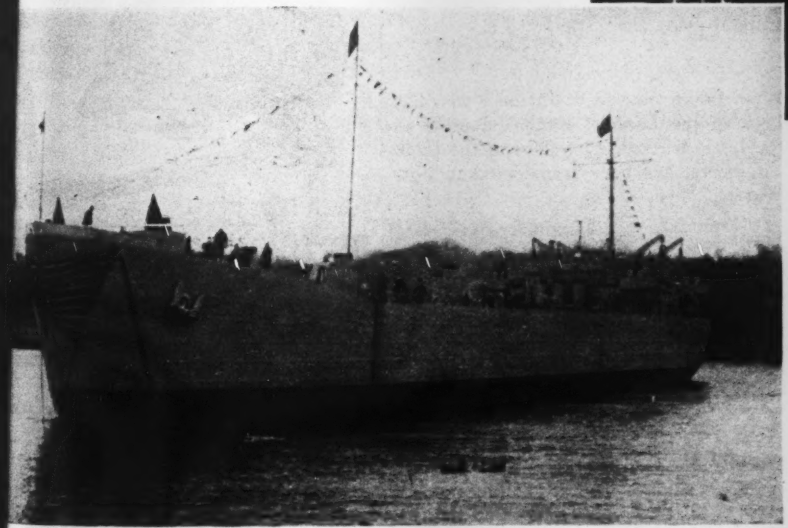
...OR TANKS?

The steel plates that we formerly used build elevated steel tanks and steel orage tanks are now going largely into ip construction or the building of tanks nd steel plate work for War industries uch as synthetic rubber, aviation gaso- ine or aluminum plants. Unfortunately e do not know when those needs will be tisfied and steel will again be available r the building of tanks to provide re- erve supplies and uniform pressure in aterworks systems. In the meantime, e two most important things water- orks operators and waterworks engi- eers can do are:

1—Maintain their existing tanks by aving them inspected and painted at reg- lar intervals by reputable service organ- zations.

2—Make completed plans and designs or waterworks improvements now so hat work may proceed as soon as mate- ials are available.

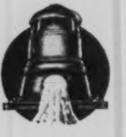




Water tanks of the future may be similar in appearance to the 250,000-gal. Watersphere shown above at Vermilion, O. Right now a lot of the metal we used to fabricate into tanks is going into ships. The view at the left shows one of a large number of ocean-going tank landing ships we are building at a new shipyard in Illinois.

BRIDGE & IRON COMPANY

Philadelphia............1623-"1700" Walnut St. Bldg.
Tulsa..............................1617 Hunt Bldg.
Birmingham...............1520 North Fiftieth Street
Washington..........................330 Bowen Bldg.
Houston.........................5609 Clinton Drive
San Francisco......................1020 Rialto Bldg.



When Hell Broke Loose In Tunis

Layne Wells and Pumps were in the thick of things when hell broke loose to crush the Axis troops in Tunis. Only the military authorities could tell of how they came through, but if they were not destroyed by the enemy—or our own terrific fire power, those sturdily built, tough and long lasting Wells and Pumps are still in there pitching—producing millions of gallons of water daily.

The Wells and Pumps in Tunis—and those throughout the African War Zone—Dakar, Algiers, Casablanca, Sousse, Kairouan, etc., were installed by Layne Engineers for peacetime duty, but they had the guts that made them give outstanding war-time service.

Whether for peace or war, Layne Well Water Systems and Pumps stand alone in skilful design, proven superior features, long life and highest efficiency. They are, according to the Layne slogan "Better Built for Better Service."

In the post-war era your Layne Wells and Pumps will be still higher in efficiency—longer in life and of further improved design. In the meantime, the Layne Organization is endeavoring to keep all industrial and municipal installations in repair and operating at peak efficiency. For literature, address, Layne & Bowler, Inc. General Offices, Memphis, Tenn.

AFFILIATED COMPANIES: Layne-Arkansas Co., Stuttgart, Ark. ★ Layne-Atlantic Co., Norfolk, Va. ★ Layne-Bowler New England Corp., Boston, Mass. ★ Layne-Central Co., Memphis, Tenn. ★ Layne-Northern Co., Mishawaka, Ind. ★ Layne-Louisiana Co., Lake Charles, La. ★ Louisiana Well Co., Monroe, La. ★ Layne-New York Co., New York City ★ Layne-Northwest Co., Milwaukee, Wis. ★ Layne-Ohio Co., Columbus, Ohio ★ Layne-Texas Co., Houston, Texas ★ Layne-Western Co., Kansas City, Mo. ★ Layne-Western Co. of Minnesota, Minneapolis, Minn. ★ International Water Supply Ltd., London, Ontario, Canada.

LAYNE

WELL WATER SYSTEMS
DEEP WELL PUMPS

Builders of Well Water Systems for Every Municipal and Industrial Need

MEN AND JOBS

Ray Spurzem of Kalispell, Mont., has been appointed acting district engineer at Kalispell by the Montana State Highway Commission. He succeeds M. C. Lockey who has entered the naval construction service.

Harry Lockland, regional engineer of Seattle, Wash., for the Federal Works Agency, has been commissioned a major in the U. S. Army and will attend the School of Military Government at the University of Virginia.

Lem Wanamaker has resigned as Ireland County (Wash.) engineer and is now with the engineers at the naval station near Oak Harbor, Wash.

Nate Biederman, president of Midwest Construction & Asphalt Co., Chicago, Ill., has resigned that position to accept a commission as lieutenant commander in the Navy construction battalions.

Douglas W. Ambridge has been appointed director general of shipbuilding for Canada. Mr. Ambridge is a graduate in engineering of McGill University and is on leave of absence from the Ontario Paper Co. Ltd., of which he is assistant general manager.

First. Lieut. Marvin C. Pittman who has been in the Labor Relations Section of the Little Rock district office of the U. S. Engineers, has been transferred to Fort Warren, Wyo.

W. H. Weir, who has been a major in the Sanitary Corps, U. S. Army, was promoted to lieutenant-colonel on May 12. Colonel Weir was formerly associate director of sanitary engineering of the Georgia State Health Department.

Charles E. Carl, former instructor in sanitary engineering at South Dakota State College, and recently with the Missouri State Department of Health, has been commissioned 1st lieutenant, Sanitary Corps, U. S. Army. He is stationed at Carlyle Barracks, Pa.

W. W. Towne has been commissioned captain, Sanitary Corps, U. S. Army. Captain Towne was formerly director,

TO ECONOMIZE GALVANIZE AT—
ENTERPRISE
where your most exacting specifications are met

GALVANIZED PRODUCTS FURNISH
ENTERPRIS
GALVANIZING CO.
2500 E. Cumberland St. Philadelphia, Penn

Compact! Powerful! Safe

DISTRIBUTABLE CONTROLLED POWER

with Beebe Bros. ALL STEEL HAND HOIST
SEATTLE, U.S.A.

★

Money Has Been Saved on These Jobs

1200' assembled pipe (132 Tons) were lowered to bed of Mississippi at St. Paul with 9—5-Ton Beebes, three lines to each hoist through blocks.
Hudson River Bridge sidewalks were laid in sections with 32—5-Ton Beebes.
Longest wooden trusses in world were installed with ONE 5-Ton Beebe after power hoists proved impractical.

★

When raising, lowering, or placing costs by power are a serious problem, the answer is the right number of Beebe Bros. All Steel Hand Hoists MANNED IN UNISON. Available in 2, 5 and 15 Ton sizes. Sold through leading dealers in all trade centers. List of dealers sent upon request.

BEEBE BROS., 2720 6th Ave. S., Seattle, U.S.A

★

"THE STRONGEST GEARED POWER FOR ITS WEIGHT IN THE WORLD"

WHEN YOU MUST MAKE YOUR OWN WELDED FITTINGS...

AIRCO
PIPE TEMPLATES
FOR WELDED FITTINGS
AIR REDUCTION

...this NEW Booklet shows you how

When time is short . . . standard welding fittings are not immediately available...and you must make your own—Airco's new booklet "Pipe Templates for Welded Fittings" shows you how. This 12 page illustrated booklet describes how to develop and use templates for fabricating many commonly used welded pipe fittings. A sequence of photographs clearly illustrates the correct flame cutting and welding procedure to be followed.

With the help of this booklet, even relatively inexperienced workers can make accurate pipe connections that are tight fitting and leak proof. Moreover, by eliminating guess-work in fitting up pipe, this booklet saves you valuable time and labor and helps conserve vital materials.

If you work with piping be sure to send for your copy of this booklet today. We will be glad to send you as many free copies as you desire. Please fill out and mail the attached coupon and indicate the number of copies you require.

MAIL COUPON FOR FREE COPY

AIR REDUCTION

AIRCO

FOR VICTORY BUY UNITED STATES WAR BONDS STAMPS

60 EAST 42nd STREET, NEW YORK, N. Y.

In Texas: Magnolia Airco Gas Products Co.

AIR REDUCTION, Advertising Department HPAC
60 East 42nd Street, New York, N. Y.

Please send me______copies of the free booklet "Pipe Templates for Welded Fittings."

*Name*____________________

*Company*____________________

*Address*____________________

IDLE CYLINDERS ARE PRODUCTION SLACKERS: KEEP 'EM ROLLING FOR VICTORY!

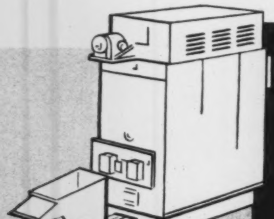
how to use economical
direct fired heating
where coal is the available fuel

☛ *heating* industrial plants by means of direct fired warm air heaters fired with gas or oil has long been an accepted, economical practice. Now coal fired models are available for automatic bin or hopper feed stokers, hard or soft coal, in capacities of 1,000,000 to 4,000,000 B.t.u. per hour output.

War-time savings—in critical metals—labor hours of installation and maintenance—in fuel and its transportation are so important as to demand thorough investigation.

Those considering conversion to coal heat or new building to be heated with coal are welcome to copies of Dravo booklets 505 and 506.

DRAVO CORPORATION
Dravo Building Pittsburgh, Pa.



DRAVO
DIRECT FIRED
HEATERS

Hayward
Buckets

Use this Class "E" Clam Shell Bucket for handling crushed stone, gravel, sand and other bulk materials.
THE HAYWARD CO., 48-50 Church St., N. Y.

Fast, Dependable
SHOVELS, CRANES
DRAGLINES, BACK HOES
Crawler or Truck—Gas or Diesel
10 Models of 3/4-5/8-1/2-3/8 cu. yd.
THE BYERS MACHINE COMPANY
RAVENNA, OHIO
DISTRIBUTORS THROUGHOUT THE WORLD

division of sanitary engineering, So
Dakota State Board of Health. In 1
he obtained leave of absence from
work in South Dakota and served
year as assistant professor, College
Engineering, University of Missouri,
lowing which he was commissioned sa
tary engineer, U. S. Public Health Se
ice. He served in this capacity
Cleveland, Ohio, until entering the arm

Thomas Schultz, sanitary engineer, P
nington County health department, Ra
City, S. D., has been commissioned 2
lieutenant, U. S. Army, and will rep
to Camp Barkeley, Tex. Lieutena
Schultz has been with the state board
health and county health department
South Dakota for the past three yea

William States Lee, Jr., Charlotte, N.
has been promoted to the rank of co
mander in the U. S. Navy. He heads t
15th Naval Construction Battalion in t
South Pacific.

J. Julian Carr, Raleigh, N. C., has bee
promoted to the rank of captain and
stationed with the 162nd Engineers
Fort Clark, Tex. He is a graduate of th
Virginia Polytechnic Institute.

David Lewis Richardson, Raleigh, N. C
has been promoted to the rank of firs
lieutenant in the Army Engineer Corp
He is company commander at Cam
Campbell, Ky. He is a graduate in engi
neering from the North Carolina Stat
College.

J. E. Dennis, vice president of the V. P
Loftis Co., Charlotte, N. C., engineerin
and contracting firm, has just been com
missioned a lieutenant commander in th
Naval Reserve.

J. R. Lemieux, has been appointed manager of the town of Arvida, Que., which is the base of the aluminum industry in the Lake St. John district of the province of Quebec. Mr. Lemieux is a graduate civil engineer from the Ecole Polytechnique of Montreal.

J. Emile St. Laurent has been appointed vice president and chief engineer of the National Harbour Board of Canada. Mr. St. Laurent graduated in civil engineering from the Ecole Polytechnique of Montreal in 1909. Until 1938 he was district engineer at Ottawa, Ont. That year he was appointed chief engineer of the St. Lawrence River Ship Canal.

LOCOMOTIVES CAN'T FLY, BUT -

Engineers responsible for designing airport runways know that some modern planes—heavy bombers and transports—have wheel loads greater than the wheel loads of the heaviest steam locomotives. Runways safe for landings and take-offs with such wheel loads require pavement of unquestioned load-carrying capacity.

Looking ahead to even heavier planes, Portland Cement Association engineers have prepared design tables for wheel loads of more than 150,000 lb. These tables, giving engineering design formulas for any load, are available to all designers of airport pavement for present or postwar needs.

Speed of Construction. 20,000 square yards of concrete airport pavement has been completed in a single working day. Minimum delays for cold or bad weather.

Saving of Materials and Transportation. Concrete construction provides strength for heaviest service with minimum use of critical materials and railroad rolling stock.

Lowest First Cost and Maintenance. Heavy duty concrete runways almost always cost less to build than other surfaces with equal load-carrying capacity. Their low maintenance conserves wartime labor and materials, reduces final cost.

Services of our experienced engineers are available to help with design and construction of war paving projects.

PORTLAND CEMENT ASSOCIATION
Dept. A6a-17, 33 W. Grand Ave., Chicago 10, Ill.

A national organization to improve and extend the uses of concrete
. . . through scientific research and engineering field work

BUY MORE WAR BONDS

HYDRO-TITE

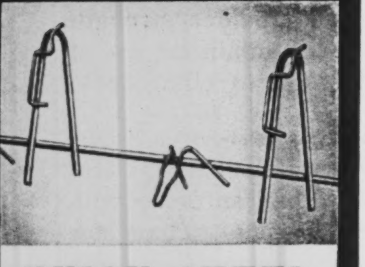
The dependable self-caulking joint compound for jointing cast iron water mains — uniform — easy to prepare — easy to use — in service for more than 30 years.

HYDRAULIC DEVELOPMENT CORPORATION
50 Church St., New York, N. Y.

FIBREX — A sanitary packing used like braided jute — will not breed bacteria — 30% lighter than jute — put up in 60 pound reels.

DRY BRAIDED
Fibrex

Eliminate **TIE WIRES**
Save Material, Time and Labor



UNION STEEL
Combination Snap-In Slab Spacer and Hi-Chair

- These US 417 units permit "factory production" on the job. They greatly speed up placement of concrete reinforcement. They eliminate all tie wires. Can be used on any reinforced concrete construction . . . especially recommended for bridges, igloos, war plants, etc. . . . comply with Federal Specifications.

SPECIALTIES: Union Steel offers a wide variety of construction specialties. Write for catalog. See Sweet's, Sec. 3-52.

UNION STEEL PRODUCTS CO.
417 Pine st. • Abion, Mich.

SEE OUR CATALOG IN SWEET'S

MEETINGS

American Water Works Association, annual meeting Hotel Statler, Cleveland, Ohio, June 15-18.

Society for the Promotion of Engineering Education, 50th anniversary meeting, Chicago, Ill., June 18-20.

Associated General Contractors of America, Inc., spring meeting, Drake Hotel, Chicago, Ill., June 27-29.

American Society for Testing Materials, 46th annual meeting, Hotel William Penn, Pittsburgh, Pa., June 28–July 2.

Regional and Local Meetings

Pennsylvania Sewage Works Association and Pennsylvania Water Works Operators' Association, Penn Harris Hotel, Harrisburg, Pa., June 8-9.

Elections and Activities

Clifford Fore, Carbondale, has been elected chairman of the Illinois section, American Water Works Association. Other officers elected are Herbert L. White, vice-chairman; John P. Harris, Chicago, trustee for three years, and H. E. Hudson, Jr., Chicago, secretary-treasurer.

Vernon Pearson, mechanical superintendent of the department of public works for Alberta, Canada, has been elected president of the Alberta Association of Professional Engineers.

The Metropolitan Section (New York) of the American Society of Civil Engineers, at its annual meeting held on the New York University campus, May 19, elected Irving V. A. Huie, commissioner of the Department of Public Works, New York City, as president to succeed Dean Thorndike Saville of N.Y.U. Other new officers elected were: vice president, Prof. James K. Finch, and directors, Shortridge Hardesty, Leonard C. Jordan, and Prof. Harold E. Wessman.

Try them on you toughest pro lems

For years th Hool and Kinne Library has been providin structural engineers with the fac they need *on every problem concerne with the design and construction civil engineering structures.* This is library that must be USED to be full appreciated—that is why we wa YOU to use it. We want you to forg the financial side of this propositio until you have solved some knott problem that you may be up again —to find out how a specialist in th particular field would handle it. W want to prove to you that this librar furnishes you with what amounts t the consulting services of 54 recog nized structural engineering special ists.

HOOL AND KINNE'S
STRUCTURAL ENGINEERS' Handbook Library

THESE six books offer you the most complete compilation of structural engineering data ever published; they furnish you with genuinely professional information drawn from records of actual practice and written by a large staff of specialists.

They cover the how and why of foundation and substructure design and construction, the general theory of structural members, the detailed design of such members and the design of their connecton with other members—they explain the principles of statics, reactions, moments and shears in beams and trusses, influence lines, methods of computing stresses in lateral trusses and portal bracing—they give details of design and construction of steel, timber and concrete structures of all types.

Examine the Library for 10 days in your home or office

6 volumes, 3575 pages, fully illustrated.

McGraw-Hill Book Company, Inc.
330 West 42nd St., New York

You may send me **Hool and Kinne's** Structural **Engineer's Library** for my inspection. If the books prove satisfactory, I will send $3.50 in 10 days and $3.00 per month until I have paid the price of the books, $27.50. If the books are not what I want, I agree to return them postpaid within 10 days of receipt.

Signature ....
Home Address ....
City and State.....................................
Name of Company...............................
Occupation ....
(To insure prompt shipment write plainly and fill in all lines.) NR 6-3-43

RMORED *in* PLASTIC

THIS NEW 1/4" PORTABLE ELECTRIC DRILL IS 14% LIGHTER . . . HAS MORE POWER PER POUND!

Thor, U14K
1/4" Drill

U14K SPECIFICATIONS

Capacity	1/4"
Length	8-3/16"
Weight	3 1/4 lbs.
Free Speed	2500 r.p.m.

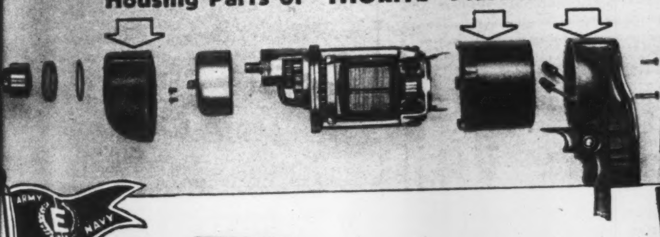
(also available in speed of 3700 and 5000 r.p.m.)

14 percent lighter in weight, more powerful per pound, cooler to handle, and far safer, the new Thor "Armored in Plastic" 1/4 inch portable electric drill brings remarkable new speed and operating ease to every war production drilling job.

The "Armored in Plastic" construction of this Thor drill is unique, for the tough, new, specially developed "Thorite" plastic does not support any operating parts, but serves only as a protective armor. In fact, the drill will operate perfectly with the plastic armor entirely removed!

The new Thor "Armored in Plastic" drill is available *now* to war industries. For full information send the coupon.

Housing Parts of "THORITE" Plastic:



Advantages of the Thor U14K That Speed Production and Assure Long Service Life

MORE POWER PER POUND—Over-capacity, high-torque Thor AC-DC motor provides heavy-duty drilling power in light weight tool for continuous production service.

14% LIGHTER WEIGHT—Housing of tough, light "Thorite" plastic; skeleton motor-and-gear-frame of strong, light aluminum permits compact, weight-saving design without sacrifice of motor size or power. Only 3 1/4 lbs., the heavy-duty Thor U14K is 14% lighter than comparably-rated, old-style machines.

NEW HANDLING COMFORT—Smooth contours and "natural-fit" grip make the U14K comfortable to handle for continuous working. Perfect balance and light weight permits "finger-point" drilling accuracy with easy, one-hand operation.

COOL-RUNNING—Oversize fan and ample intake and exhaust slots circulate generous volumes of air through tool to make it extremely cool running. Heat-resisting "Thorite" plastic housing stays cool in the hand.

GREATER SAFETY—"Thorite" plastic — a non-conductor — is added protection against shock. Three-conductor cable with ground wire and neoprene-sealed switch are other Underwriter Approved features

This Skeleton Frame is Secret Of Its Amazing Strength

This sturdy metal frame supports all internal operating parts of the Thor plastic drill, insuring close tolerance and permanent alignment of all parts. The plastic housing does *not* support any working parts, but serves only as a protective armor.

ARMY E NAVY

THOR'S 50th YEAR

Thor *Portable Pneumatic and Electric Tools*

INDEPENDENT PNEUMATIC TOOL COMPANY

600 W. JACKSON BOULEVARD, CHICAGO, ILL.
Branches in Principal Cities

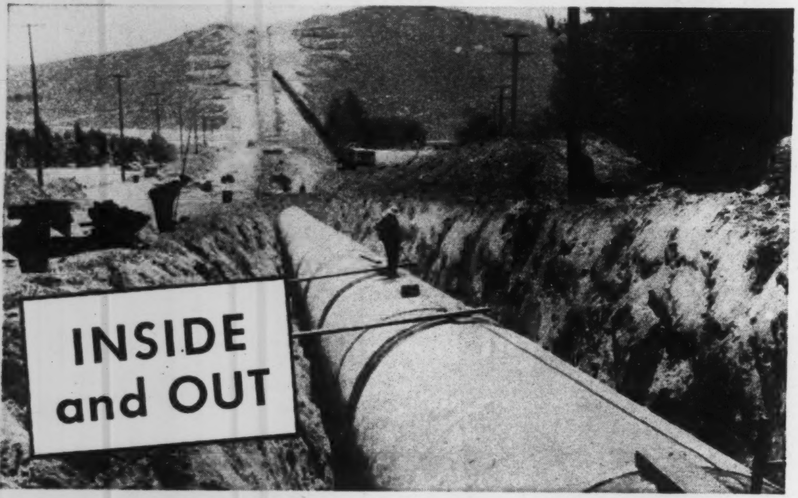
ADDITIONAL INFORMATION

Independent Pneumatic Tool Co.
600 W. Jackson Blvd., Chicago, Ill.

Please send full engineering data on the new Thor "Plastic" Drill.

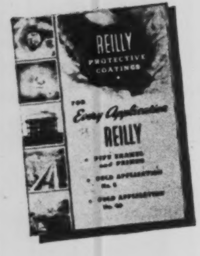
Name ....
Title ....
Company ....
Address ....
City .... State ....

☆ Dependable Protection



With REILLY PIPE ENAMEL

Pipe lines coated with REILLY ENAMEL give long and dependable service and low maintenance costs in all types of soil and under wide extremes of temperature. The tough, durable REILLY coating effectually prevents corrosion from moisture, electrolysis, soil acids and alkalies; resists abrasion and soil stress, and will not crack in sub-zero cold or sag in tropical heat. . . . As an inner lining on water mains, REILLY ENAMEL protects against incrustations and tuberculation and assures full-capacity flow for the life of the pipe. . . . On storage tanks, structural steel work and other metal surfaces REILLY Coal Tar Paints give effective, economical protection against corrosive vapors and gases.



Booklet describing
REILLY Protective Coatings
will be sent on request.

REILLY TAR & CHEMICAL CORPORATION
Executive Offices: Merchants Bank Building, Indianapolis, Indiana
2513 S. DAMEN AVENUE, CHICAGO, ILLINOIS · 500 FIFTH AVENUE, NEW YORK, N. Y. · ST. LOUIS PARK, MINNEAPOLIS, MINN.
SEVENTEEN · PLANTS · TO · SERVE · YOU

NEED A BIG Trailer?

La Crosse Makes Them Up To 200 Ton Capacity-
★★ WRITE OR WIRE ★★

LA CROSSE TRAILER & EQUIPT. CO.
LA CROSSE, WISCONSIN U.S.A.

"GUNITE"

can reduce your construction costs. It is efficient and dependable, an established product.
WE RECOMMEND "GUNITE" for structural steel protection, floor and roof slabs, thin exterior walls, partitions, tanks, reservoirs, restoring disintegrated concrete surfaces, repairing reinforced concrete, etc. Let us suggest how "Gunite" can best solve your problems.

PRESSURE CONCRETE CO.
"GUNITE" CONTRACTORS
6 Avenue B · Newark, N. J.

POST WAR PROJECTS

WATERWORKS

Calif., Healdsburg—City, steel, con permanent dam to replace present w dam. H. M. Engle, 110 Sutter St., San cisco, engr. A. B. Stuart, city engr.

Minn., Barnesville—City, iron removal $15,000, General Filter Co., Ames, Ia.,

Minn., Duluth—City, C. D. Jeronimus, auxiliary water mains, incl. 725 ft. 3 watermain and steel trestle across River, $158,000. I. W. Ward, city engr.

Minn., Granite Falls—City, S. E. Ne clk., exten. watermains. $25,000. C. Barager, city engr.

Minn., South St. Paul—City, water reser 17 Ave. and Third St. N. $60,000. Con Townsend & Quinlan, 211 W. Wacker Chicago, Ill., engrs. CD 5/19—ENR 5/27

Minn., South St. Paul—City, J. F. O' nell, clk., made plans well, pump house feeder mains, $20,000. R. E. Monson, engr.

Neb., Norfolk—City, enlarging water d sys. $22,750. H. H. Tracy, city engr.

Ore., Silverton—City, filtration plant water sys. $40,000. C. Green, 7441 S.E. St., Portland, engr.

Tex., Corpus Christi—City, A. C. McCaug mayor, waterworks sys., sanitary and st sewer imprvs., etc.

★ **Tex., Eastland**—City, new water su facilities. $500,800. J. E. Ward, 545 E vey-Snider Bldg., Wichita Falls, engr.

Tex., El Paso—El Paso Co. Water Contr Imprvt. Dist 1, 405 Caples Bldg., new f water supply facilities, 250,000 lin. ft. 2- to in. pipe, etc. $400,000. Frazer & Ben 705 El Paso Natl. Bank Bldg., engrs.

Ont., Niagara Falls—Municipality, W. Orr, clk., Ont., exten. pipeline from Chipp to Falls View. $260,000. CD 4/8—ENR 4

SEWERS & WASTE DISPOSAL

Minn., Chatfield—City, sanitary sewers watermain exten., $75,000. Toltz, King & D 1509 Pioneer Bldg., St. Paul, engrs.

Minn., Crookston—City, L. Skogness, c interceptor sewerage sys., disposal plant. Deneen, city engr.

Minn., Faribault—City, sewage dispo plant. $250,000. Sanitary sewerage $85,000. F. McKellip, city engr.

Minn., Farmington—Town, Mrs. M. Ack man, clk., sewage disposal plant.

Minn., Granite Falls—City, S. E. Nels clk., sanitary sewers. $32,000. C. A. Barag city engr.

Minn., Hibbing—City, C. Aura, clk., sto and sanitary sewer extens. $52,000. H. Danahy, acting city engr.

Minn., Jackson—City, sewage dispo plant. A. E. Wallace, city engr.

Minn., Little Falls—City, C. E. McPherso clk., made preliminary survey conversion separation sanitary sewers with possible co struction new storm sewer. $150,000-$200,0 A. R. Msarquardt, city engr. G. M. Orr Co., 1901 Foshay Tower, Minneapolis, eng

Minn., Olivia—City, sewage disposal pla $30,000. J. J. Davy, La Crosse, Wis., engr.

Minn., South St. Paul—City, J. F. O'Do nell, clk., sanitary sewerage sys., North a South Ends. $437,000. R. E. Monson, c engr.

Neb., Norfolk—A. W. Breyer, mayor, sewage disposal plant. $161,000. H. H. Trac city engr.

★ **N. Y., New York**—Dpt. P. Wks., Municip Bldg., Hunts Point Sewage Treatme Works. $9,000,000. Greeley & Hansen, 6 Nort Michigan Ave., Chicago, Ill., engrs.

★ **N. Y., Rockaway**—Dpt. P. Wks., Municip Bldg., New York, Rockaway Sewage Treatment Works, near Beach Channel Dr. an Beach 108 St., $1,200,000. Metcalf & Edd Statler Bldg., Boston, Mass., engrs.

Tex., Dallas—Dallas Co. Arcadia Fres Water Dist. 1, C. E. Granger, Rte. 8, Box 46 sanitary disposal plant and some collectin lines, $48,000; sanitary and storm sewe facilities, etc. $37,000. Myers & Noyes, Towe Petroleum Bldg., engr.

★ **Tex., Houston**—City, J. Edy, mgr., sanitary sewers, $2,000,000. CD 5/7—EN 5/13.

Tex., San Antonio—City, G. B. Mauermann mayor, sanitary sewerage sys. and sewage disposal plant expansion. Over $25,000.

Ont., Chatham—Municipality, c/o W. M Foreman, clk., intercepting sewers $25,000; sewage disposal plant. $75,000.

Ont., Whitby—Town, E. T. Rowe, mayor, sewage disposal plant repairs, addns., exten. sanitary main sewer from disposal plant to point west of Henry St., constructing incinerator, reconstructing water tower, sidewalks, 15 mi. new streets, overhead bridge

EXTRA
The Evening News
EXTRA
FOUR CENTS
NO. 18,295
NEWARK GETS 77 %
INCREASE IN WATER

A worthy reconditioning job has been completed! The City of Newark is now obtaining a 77% increase in the amount of water delivered by an old 48″ main after a complete renovation by the Centriline process.

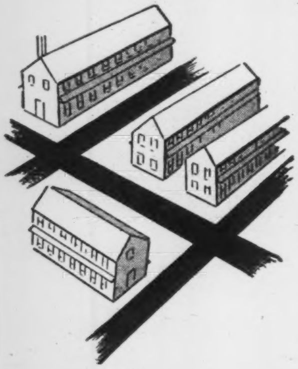
This was a timely investment. For, at low present day costs, *one half months' sales of the additional water which can be brought through this pipeline pays for one mile of reconditioning.* The Centriline process is a rapid and economical method of reconditioning pipelines. It consists of first cleaning the main and then applying by centrifugal force, a dense cement mortar lining of required thickness, mechanically troweled to a smooth finish. This inner jacket of protective cement will permanently resist the invasion of tuberculation and corrosion and will restore and maintain a high carrying capacity.

* * *

Recondition now and cut depreciation and pumping costs to a minimum. Let our years of experience show you how to safeguard your initial investment.

CENTRILINE CORPORATION
144 CEDAR STREET • NEW YORK, N. Y.
Restores and Protects Pipe-Line Carrying Capacity

# ASPHALT
for
CANTONMENT STREETS

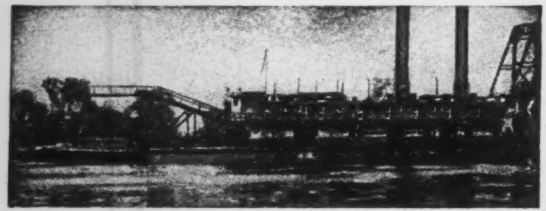


Various low-cost types of Asphalt construction are ideally suited for cantonment streets where an improved all-weather surface is needed. Asphalt can be easily maintained for as long as it is needed, and can be abandoned at any time without a great investment loss.

Wherever Standard Oil Asphalt products are sold, there is an Asphalt Representative who can give you full information about these and other uses of Asphalt. Write

STANDARD OIL COMPANY (Indiana)
910 SOUTH MICHIGAN AVENUE, CHICAGO

DREDGING



Filling, Land Reclamation, Canals and Port Works

River and Harbor Improvements
Deep Waterways and Ship Channels

We are equipped to execute all kinds of dredging, reclamation and port work anywhere in the United States

Contractors to the Federal Government

Correspondence invited from Corporate and Private Interests Everywhere

Largest Plant — Longest Experience

Atlantic, Gulf and Pacific Co.

21 Park Row
New York

Citizens State Bank Bldg.
Houston, Texas

POSTWAR PROJECTS (Cont'd)

over Canadian Pacific R. tracks on St. W., dredging and reconstructing Harbor, etc.

BRIDGES, GRADE CROSSIN ELIMINATION

†District of Columbia—The Commis Fine Arts, Interior Dpt. Bldg., Wash., chusetts Ave. Bridge across the Anaco connect with east Washington; South St. bridge; new 14 St. bridge; Dupont underpass; subway for use of taxicabs main floor of Union Station; bridge Potomac River at Great Falls.

Mo., Kansas City—City, c/o S. H Hare, consultant to the Park Bd. an Plan Comn., and J. V. Lewis, supt. Ward Parkway bridge over Brush $54,000; underpass at 39 and Gillham $162,500.

★ **New York**—Bd. Supervs. Erie Co., B 2 steel, concrete hy. bridges, North and Lancaster, $100,000; McKinley Grade crossing elimination, $750,000; el tion work, Lancaster, $410,000; under Tonawanda, $425,000; bridge replac Eden, $80,000; bridge, Marilla, $75,000. Yaw, co. supt. hys.

★ **Virginia**—State Hy. Dpt., Richmond bridges over New River at Radfor over Mattaponi River at West Point, $1 000; allocated $5,000,000 to be distribu counties for projects to be included in s ary system of hys., incl. relocation Rou in Amherst and Nelson Counties, wid Route 58 between South Boston, Halifa and Mecklenburg Co. line, widening Ro from Bottoms Bridge, eastward and b around Fredericksburg.

Ont., Niagara Falls—Municipality, Orr, clk., subway at Clifton Hill, $35 CD 4/8—ENR 4/15.

ROADS

†District of Columbia—The Commissi Fine Arts, Interior Dpt. Bldg., Wash., lane drive, Washington-Baltimore Blvd. velopment Fort Drive a parkway to en National Capitol; development E. C street from the Capitol east to the Anac development of Pennsylvania Ave. we White House; completion Great Plaza in angle south of Pennsylvania Ave. adj to 14th St. development Independence from 14 St. westward to Potomac Rive St. elevated hy. along 26 St. to Georget development George Washington Mem Parkway from Great Falls to Mount Ve

★ **Minn., Duluth**—St. Louis Co., subm $3,510,570 road imprv. program to Fe Works Reserve, incl. grading, graveling tuminous surfacing, piling of 385 mi. hy. in cost estimate $524,056 for replacement lete bridges.

★ **Mo., Kansas City**—City, c/o S. He Hare, consultant to Park Bd. and Plan Comn., and J. V. Lewis, Supt. P widening Warwick St. from 34 St. to B Creek Blvd. $34,000; Paseo St. from 31 t Sts., $50,000; Linwood Blvd. from Bento Van Brunt Sts., $60,000; imprv. Brush C Blvd. from Brookside to Benton Sts., $ 900; drives and Parkway around Lagoon Swope Park, $150,000; walks and dr around Swope Park zoo, $46,000.

★ **New York**—Bd. Supervs. Erie Co., Bu realignment Tonawanda Creek Rd., $1 000; widening, resurfacing Abbott Rd., La awanna, $475,000; relocation Lake View Hamburg, $210,000; Walden Ave. reconstr tion from Harlem to Transit Rds., Buf $435,000. A. J. Yaw, co. supt. hys.

Tex., Corpus Christi—City, A. C. McCaug mayor, widening, paving, imprv. stre bridges, etc.

★ **Tex., Houston**—City, J. Edy, mgr., pav and right of ways, $1,300,000. CD 5/ ENR 5/13.

Ont., Mimico—A. H. Waites, mayor, pa ments, sidewalks, storm sewers, sewage posal plant exten., watermains, new to hall, reconstructing existing fire station, in conjunction with other Lake Shore mun palities to build a municipal auditori James, Procter & Redfern, 36 Toronto Toronto, engrs.

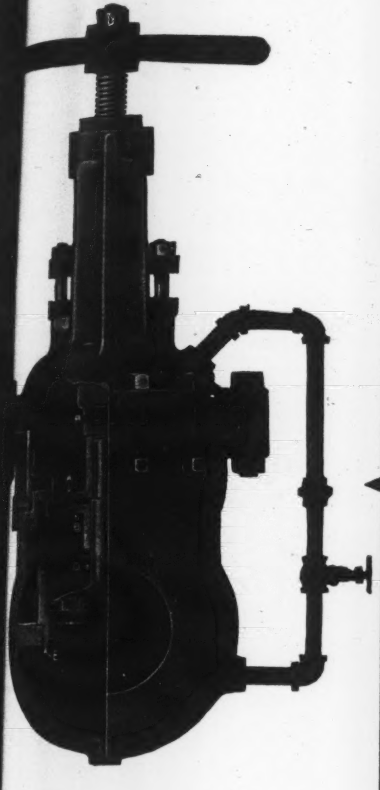
EARTHWORK—IRRIGATION, DRAINAGE—WATERWAYS

†District of Columbia—The Commission Fine Arts, Interior Dpt. Bldg., Was completion water-front development alo Washington Channel, incl. development fr Lincoln Memorial to Francis Scott K Bridge.

Tex., Corpus Christi—City, A. C. McCaugha mayor, drainage facilities, Bay Front imprv etc.

Tex., Edinburg—Lower Rio Grande Vall Water Conservation Assn., Edinburg (Draina Dists. 1 and 2), constructing drainage sy in central portion Hidalgo Co. $250,000. H. Griffin, Edinburg, co. engr. Hidalgo Co. C 6/6/41—ENR 6/12/41.

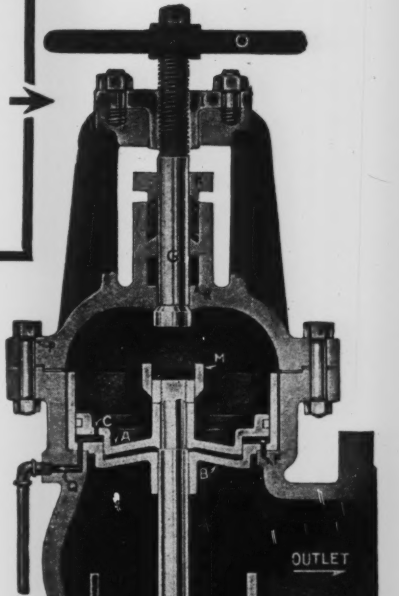
Tex., Fort Worth—Tarrant County Wat Control & Imprvt. Dist. 3, flood control wor on Marine Creek and Trinity River, $275,0



Golden Anderson SPECIALTY VALVES

The Throttle and Emergency Stop Valve gives positive protection against runaway engines or turbines. It works instantly . . . mechanically, electrically, by hand or remote control. No unit can exceed safe operation speed when equipped with this unit as maximum speeds can be rigidly controlled. We will supply this valve in angle and globe patterns from $2\frac{1}{2}$" to 16" size.

Make safety in your boiler plant a certainty with G-A Non-Return Valves. This valve automatically cuts off the inflow of steam from the whole line the instant any rupture occurs, thus there can be no boiler explosions or bursting steam lines. Comes with either flanged ends or welded necks . . . handles 150 lbs. to 1500 lbs. In angle, globe or elbow types from $2\frac{1}{2}$" to 16".



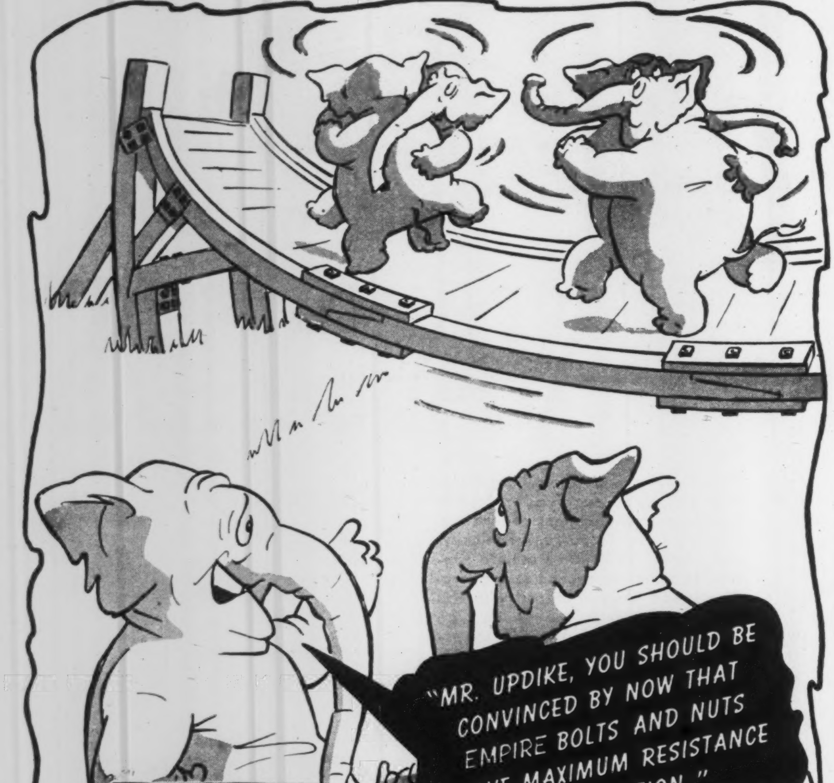
For nearly 40 years GOLDEN-ANDERSON has been pro- cting Life and Property in the power plant with G-A mergency Valves". Moreover, continuous development d research has provided us with a wealth of "know-how" . experience that has evolved the complete line of G-A ecialty Valves. Each G-A Valve has been designed to do specific, specialized job — and do it right! Today, when l-capacity operation is so essential, specify GOLDEN- NDERSON . . . be sure of continuous service and minimum down-time".

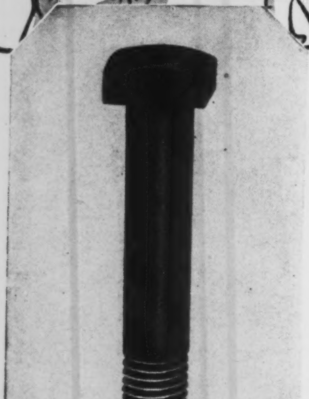
Our new illustrated catalog gives complete information on G-A Specialty Valves. Write for it today.

lso

ALTITUDE CONTROL . . .
FLOAT CONTROL . . .
PRESSURE REDUCING . . .
CHECK VALVES, ETC. . . .

GOLDEN-ANDERSON VALVE SPECIALTY CO.
FULTON BLDG. PITTSBURGH, PA.


"MR. UPDIKE, YOU SHOULD BE CONVINCED BY NOW THAT EMPIRE BOLTS AND NUTS HAVE MAXIMUM RESISTANCE TO VIBRATION."



EMPIRE COLD-HEADED BOLTS*

STRONGER—Close-grained metal used; grain structure intensified by bolt-making processes and heat treatment.

TOUGHER—Cold-reduction of shank toughens skin surface for threading.

CLEANER—Threads *cold-worked;* strong, accurate, clean for quick assembly.

QUICKER—Point chamfered (60°) for ease in assembly.

*Up to ⅞" x 8"; larger sizes manufactured by another method.

EMPIRE NUTS*

STRONGER—Hole is punched at *right angles* to grain — no splitting.

TOUGHER—Processed to guard against stripped threads.

CLEANER—Tapping is done with frequently-changed taps.

QUICKER—Accurate tapping means nuts run on fast; counter-boring of hole means quick get-away.

*Regular nuts are processed cold through ⅞".

EMPIRE
and allied fastening products since 1845

RB&W *Making strong the things that make America strong*

RUSSELL, BURDSALL & WARD BOLT & NUT COMPANY

Factories at Port Chester, N. Y., Rock Falls, Ill., Coraopolis, Pa.
Sales offices at Philadelphia, Chicago, Detroit, Chattanooga, Los Angeles, Portland, Seattle

POSTWAR PROJECTS (Cont'd.)
bonds voted; pump. un for flood
work, $75,000 bonds vot J. J. Ra
Insurance Bldg., engr. 9/23—EN

★**Tex., Houston**—City, Edy, mgr
control. $1,000,000.

Tex., San Antonio—City, G. B. Mau
mayor, river beautification plans, incl
widening river, straightening course,
ties for boating and pleasure, etc.

Ont., Chatham—Municipality, c/o
Foreman, clk., flood prevention works
dian Creek Area $25,000; bridge over
River, constructing viaducts over tra
Canadian Pacific Ry. Co. and Canadia
Rys., $200,000.

UNCLASSIFIED

★**Calif., Berkeley**—AIRPORT—Metro
Developers, c/o F. W. Parr, foot
St., Richmond, commercial airport c
3,000 acres along Eastshore hy., $70,

†**District of Columbia**—ARBORETU
Commission of Fine Arts, Interior Dpt.
Wash., national arboretum, on 500 ac

†**District of Columbia**—CEMETERY
Commission of Fine Arts, Interior Dpt.
Wash., enlarging Arlington National Ce

†**District of Columbia**—PARK and
SCAPE TREATMENT—The Commiss
Fine Arts, Interior Dpt. Bldg., Wash
velopment completion of East Potomac
landscape treatment Mount Vernon Me
Hy. 7 between Washington and Alex

†**District of Columbia** — STADIUM
Commission of Fine Arts, Interior Dpt.
Wash., national stadium end of East
tol St.

Minn., Faribault—AIRPORT—City, a
$300,000. F. McKellip, city engr. CD
ENR 2/4.

Minn., Faribault—SWIMMING POOL
swimming pool, $250,000. F. McKellip
engr.

★**Mo., Kansas City** — PARK IMPR
MENTS—City, c/o S. Herbert Hare
sultant to Park Bd. and City Plan
and J. V. Lewis, supt. Parks, swimmin
at Bud Park, $50,000; rebuilding bath
at Penn Valley Park, $55,000; Monkey
at Swope Park Zoo, $46,000; seal po
Swope Park Zoo, $28,500; lion house,
Park Zoo, $120,000; elephant house,
Park Zoo, $96,300; service barn, Swope
Zoo, $50,000; boat house, Swope Park, $5
community bldg. at the Parade, 15 and
ton Sts., $50,000.

Neb., Norfolk—SWIMMING POOL—C
W. Breyer, mayor, concrete swimming
$53,000. H. H. Tracy, city engr.

New York—TUNNEL—President Bro
Boro, Boro Hall, Brooklyn, preparatio
studies, plans, etc., in connection with lo
of approaches to Narrows Tunnel be
Brooklyn and Richmond Boros, Mad
Hyland, 2804 41 Ave., Long Island City, e

N. Y., St. George—LIGHTING, etc.—
dent Richmond Boro, Boro Hall, parkway
ing and other electrical work (except bl
incl. communicating sys., etc., Willowb
Parkway, $185,000. E. A. Sears, 13 E.
New York, engr.

Tennessee—PARKS, etc.—State Cons
tion Comm., W. M. Hay, dir. Div. State P
Memphis, state-wide parks and recre
grounds.

Tex., Houston—AIRPORT IMPROVEME
—City, J. Edy, mgr., airport imprvs. $47

Tex., Houston—FIRE ALARM, etc.—
J. Edy, mgr., fire alarm and station im
$320,000.

Tex., Houston—PARK IMPROVEMEN
City, J. Edy, mgr., park imprvs. $100
CD 5/7—ENR 5/13.

Tex., San Antonio—AIRPORT EXPANS
—City, G. B. Mauermann, mayor, muni
airport expansion, imprvs. T. Coghill,
Hall, engr.

Wis., Fort Atkinson — PIER and DOC
City, pier and dock along river, E. Klem
city engr.

★**Outside United States** — SEADROME
Pennsylvania Central Airlines, C. Be
Monro, pres., Washington National Air
Gravelly Point, Va., three 64,000 ton
dromes complete with airport facilities
hotel accommodations, spaced at 800 mi.
tervals across Atlantic Ocean, $30,000,000.
R. Armstrong, c/o owner, archt. Sun S
building Co., foot of Morton St., Phila.,
will construct. Associated are U. S. S
Corp., 71 Bway., New York, N. Y., W
Steel Co., Claymont, Del., Belmont I
Works, 44 Whitehall, New York, N. Y., J
A. Roebling's Sons Co., 640 S. Broad
Trenton, N. J.

★**Ont., Windsor**—AIRPORT—Windsor Ch
ber of Commerce, O. N. Birchard, c
International Airport southwest of h
$8,000,000. CD 5/14—ENR 5/20.

PUBLIC

†**District of Columbia**—The Commission
Fine Arts, Interior Dpt. Bldg., Wash., natio
auditorium.

WOOD and GLUE
at War!
Casein Company of America, 350 Madison Avenue, New York, N.Y.

How to do the "impossible"

Regardless of what you plan—this amazing story will stimulate your thinking

ood has changed.

ood is changing industrial hinking.

ood is doing "impossible" things.

his book tells that story—how *plas-ic resin glues* have changed wood nto industry's newest raw material.

t illustrates case histories of wood nd glue at work, under many con-itions, *doing* things more efficiently nd at lower cost.

Because of modern glues, wood now offers the best properties of many different materials. Now wood can be impregnated, compregnated, laminated, stabilized, molded or bent. These better glues make water- heat- vibration- and mold-proof joints, unaffected by organic solvents—amazingly strong and durable. Yet, the wood retains its natural warmth and richness!

Look into this story of modern glue!

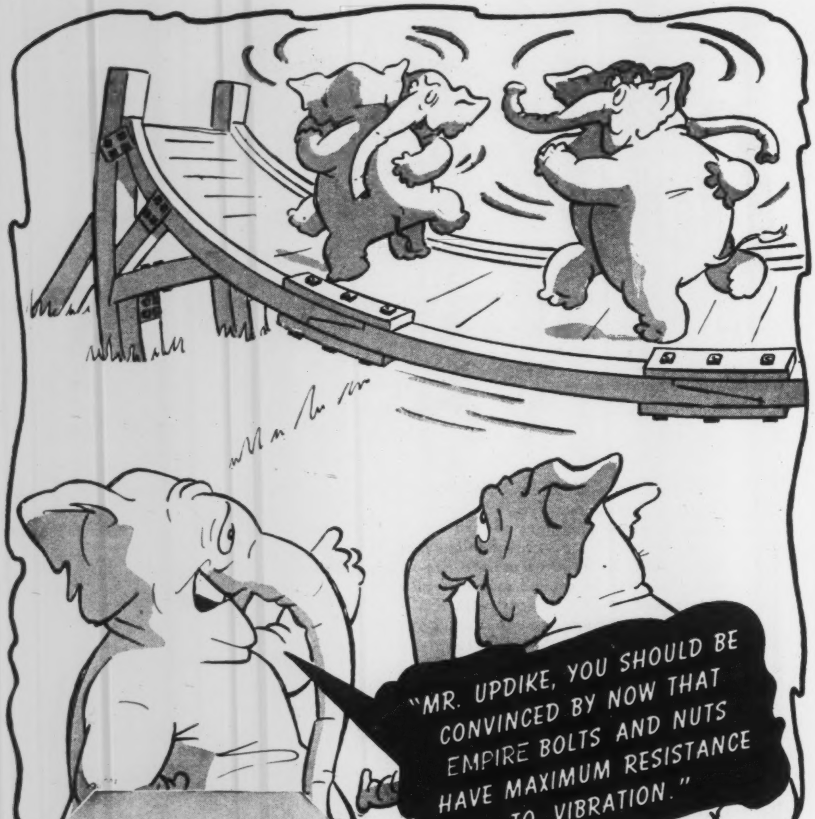
Do it with "imagination" wood and glue!

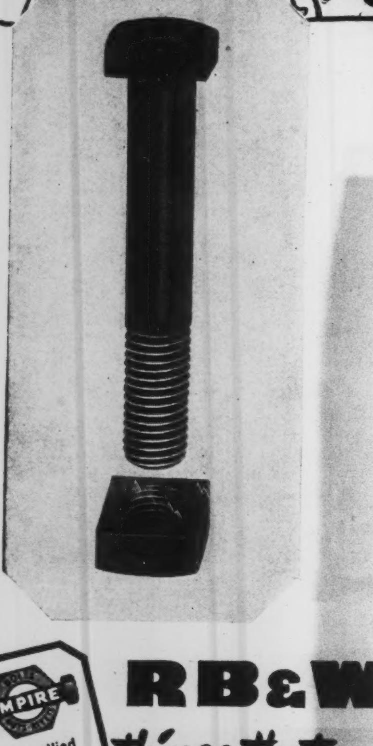
Write for this free book! Outlines new wood and glue developments. Lists Technical Service Bulletins available to designers and engineers. Stimulating. Worth reading.

GLUES FOR INDUSTRY

Casein Company of America

350 Madison Avenue, New York, 17 N. Y. Dept. AF 6
Division of The Borden Company


"MR. UPDIKE, YOU SHOULD BE CONVINCED BY NOW THAT EMPIRE BOLTS AND NUTS HAVE MAXIMUM RESISTANCE TO VIBRATION."



EMPIRE COLD-HEADED BOLTS*

STRONGER—Close-grained metal used; grain structure intensified by bolt-making processes and heat treatment.

EMPIRE
and allied fastening products since 1845

RB&W
things that m

RUSSELL, BURDSAL
Factories at Port Chester, N. Y.,
Sales offices at Philadelphia, Chicago, Detroit,

POSTWAR PROJECTS (Cont'd.)
bonds voted; pump. un for flood work, $75,000 bonds vot J. J. Ra Insurance Bldg., engr. 9/23—EN

★**Tex., Houston**—City, Edy, mgr control. **$1,000,000.**

Tex., San Antonio—City, G. B. Mau mayor, river beautification plans, incl widening river, straightening course, ties for boating and pleasure, etc.

Ont., Chatham—Municipality, c/o Foreman, clk., flood prevention works dian Creek Area $25,000; bridge over River, constructing viaducts over tra Canadian Pacific Ry. Co. and Canadia Rys., $200,000.

UNCLASSIFIED

★**Calif., Berkeley**—AIRPORT—Metro Developers, c/o F. W. Parr, foot St., Richmond, commercial airport 3,000 acres along Eastshore hy., $70,

†**District of Columbia**—ARBORETU Commission of Fine Arts, Interior Dpt. Wash., national arboretum, on 500 ac

†**District of Columbia**—CEMETER Commission of Fine Arts, Interior Dpt. Wash., enlarging Arlington National Ce

†**District of Columbia**—PARK and SCAPE TREATMENT—The Commiss Fine Arts, Interior Dpt. Bldg., Wash velopment completion of East Potomac landscape treatment Mount Vernon Me Hy. 7 between Washington and Alex

†**District of Columbia** — STADIUM Commission of Fine Arts, Interior Dpt. Wash., national stadium end of East tol St.

Minn., Faribault—AIRPORT—City, a $300,000. F. McKellip, city engr. CD ENR 2/4.

Minn., Faribault—SWIMMING POOL swimming pool, $250,000. F. McKellip engr.

★**Mo., Kansas City** — PARK IMPR MENTS—City, c/o S. Herbert Hare sultant to Park Bd. and City Plan and J. V. Lewis, supt. Parks, swimmin at Bud Park, $50,000; rebuilding bath at Penn Valley Park, $55,000; Monkey at Swope Park Zoo, $46,000; seal po Swope Park Zoo, $28,500; lion house, Park Zoo, $120,000; elephant house, Park Zoo, $96,300; service barn, Swope Zoo, $50,000; boat house, Swope Park, $5 community bldg. at the Parade, 15 and ton Sts., $50,000.

Neb., Norfolk—SWIMMING POOL—C W. Breyer, mayor, concrete swimming $53,000. H. H. Tracy, city engr.

New York—TUNNEL—President Bro Boro, Boro Hall, Brooklyn, preparatio studies, plans, etc., in connection with lo of approaches to Narrows Tunnel be Brooklyn and Richmond Boros, Mad Hyland, 2804 41 Ave., Long Island City,

TIGH

BOU

WOOD and GLUE
at War!
Casein Company of America 350 Madison Avenue, New York, N.Y.

How to do the "impossible"

HTLY

UND

Do it with "imagination" wood and glue!

Write for this free book! Outlines new wood and glue developments. Lists Technical Service Bulletins available to designers and engineers. Stimulating. Worth reading.

GRIFFIN
GRIFFIN

WELLPOINT SYSTEMS

JETTING PUMPS

FOR SALE
RENT

Prompt Shipments

Send for our New 60 page illustrated catalog "GRIFFIN POINTED WELLPOINT FACTS" chock full of latest information on Wellpoint Systems for dewatering, emergency and permanent water supply systems, also information on pressure pumps and data for jetting.

GRIFFIN WELLPOINT CORP.

881 EAST 141st ST. • NEW YORK, N. Y.

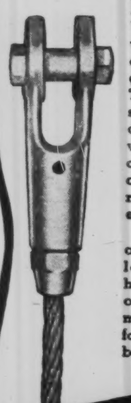
Phones: MElrose 5-7704-5-6

TIGHT BITE

..holds tight!

ELECTROLINE-FIEGE Wire Rope Connectors hold with a "Bulldog Grip" because their special design gives them a tighter bite. They are easy to install, streamlined and prevent dangers from undamped vibrations which cause crystallization, frayed cables and failures. Full rated cable strength in every connection.

Prove to yourself that they are better and why many leading wire rope users have made them standard on jobs where performances must not fail. Write today for complete details and the booklet, "Positive Grip".



Electroline FIEGE CONNECTORS

Electroline Company

4121 South La Salle Street Chicago, Illinois

POSTWAR PROJECTS (Cont'd.)

†District of Columbia—The Commission of Fine Arts, Interior Dpt. Bldg., Wash., completing public library, Pennsylvania Ave. and John Marshall Pl.

†District of Columbia—The Commission of Fine Arts, Interior Dpt. Bldg., Wash., Federal court bldg., Judiciary Sq.

†District of Columbia—The Commission of Fine Arts, Interior Dpt. Bldg., Wash., converting old Hadfield Courthouse into Washington historical bldg. for permanently exhibiting plans, models, historical pictures.

†District of Columbia—The Commission of Fine Arts, Interior Dpt. Bldg., Wash., general accounting office bldg., Five and G Sts.

†District of Columbia—The Commission of Fine Arts, Interior Dpt. Bldg., Wash., addnl. bldg. for Smithsonian Institution for National Museum use, Constitution Ave. between 12 and 14 Sts.

†District of Columbia—The Commission of Fine Arts, Interior Dpt. Bldg., Wash., new site for the National Training School for Boys.

†District of Columbia—The Commission of Fine Arts, Interior Dpt. Bldg., Wash., completion northwest rectangle, incl. War Dpt. Bldg., from 21 St. and Virginia Ave. westward to 23 St.; Navy Dpt. Bldg. west of 23 St. to Potomac River; Pharmaceutical Institute Laboratory bldg.; National Academy of Sciences addn; Federal Reserve Bldg. Annex; Public Health Service Bldg. addn.; Pan-American Annex; heating plant, 29 and K Sts. N.W.

†District of Columbia—The Commission of Fine Arts, Interior Bldg., Wash., State Department bldg., Lafayette Sq.

†District of Columbia—The Commission of Fine Arts, Interior Dpt. Bldg., Wash., exten. Treasury Dept. bldg. from Pennsylvania Ave. northward to H St.

†District of Columbia—The Commission of Fine Arts, Interior Dpt. Bldg., Wash., Historical museum in east wing of White House.

†District of Columbia—The Commission of Fine Arts, Interior Dpt. Bldg., Wash., public roads laboratory bldg., near Chain Bridge.

Minn., Dodge Center—Village, V. G. Crough, clk., municipal power and light plant. Over $100,000.

Minn., Faribault—City, T. A. Mealia, clk., municipal garage. $40,000. F. McKellip, city engr.

Minn., Faribault—City, city hall. $200,000. F. McKellip, city engr.

Minn., Faribault—City, fire station. $150,000. F. McKellip, city engr.

N. Y., Brooklyn—Dpt. P. Wks., Municipal bldg., New York, alterations to provide nursing training school facilities at Greenpoint Hospital, for Dpt. Hospitals, Municipal Bldg., New York. $200,000. G. A. Boehm, 2 W. 45 St., New York, archt.

★**N. Y., Jamaica**—Dpt. P. Wks., Municipal Bldg., New York, nurses' residence and school at Queens General Hospital, for Dpt. Hospitals, Municipal Bldg., New York. $1,060,000. W. Gehron, 101 Park Ave., New York, archt. CD 1/29—ENR 2/4.

★**N. Y., New Hampton**—Dpt. P. Wks., Municipal Bldg., New York, 2 dormitories, education bldg. and power plant addn., at New York City Reformatory. $500,000. C. Clark, 101 Park Ave., New York, archt.

★**N. Y., New York**—Bd. Educ., 49 Flatbush Ave. Exten., Brooklyn, Morris Park Vocational high school, Mansion St. and Noble Ave., Bronx Boro. $2,000,000. Tooker & Marsh, 101 Park Ave., archts.

★**N. Y., New York**—Dpt. P. Wks., Municipal Bldg., altering out-patient bldgs. at Bellevue Hospital, for Dpt. Hospitals, Municipal Bldg. $564,000. Crow, Lewis & Wick, 200-5 Ave., New York, archts.

N. Y., North Beach—Dpt. Marine & Aviation, Pier A, North River, city garage and storage bldgs., 94 St. entrance to municipal airport, LaGuardia Field. $171,000. Delano & Aldrich, 126 E. 38 St., New York, archt.

Tenn., Nashville—City, c/o T. L. Cummins, mayor, city building for police station, courtroom and workhouse. Preliminary plans by City Eng. Dpt.

Tex., Corpus Christi—City, A. C. McCaughan, mayor, municipal bldgs.

Tex., Fort Worth—Fort Worth Childrens Hospital, 4832 Bryce St., hospital bldgs., facilities, etc. $175,000. J. R. Pelich, 1103 Trinity Life Bldg., archt. CD 3/25/42—ENR 4/2/42.

Tex., Fort Worth—City, S. H. Bothwell, mgr., constructing Casa Manana Bldg. unit. $225,000.

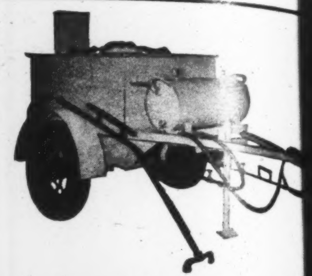
Tex., San Antonio—City, G. B. Mauermann, mayor, facilities for livestock show, incl. grandstand, exhibition area, stables, etc.

Ont., Kitchener—Municipality in conjunction with Municipality of Waterloo, public auditorium and ice arena. $150,000. CD 4/5.

Ont., Kitchener—Municipality, gas plant $200,000. CD 4/5.

★**Ont., London**—Municipality, auditorium, hospital addn., etc. $1,371,000.

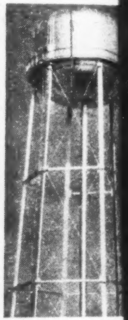
Ont., Niagara Falls—Municipality, W. S. Orr, clk., gymnasium at Collegiate Institute. $150,000. CD 4/8.



HEATING KETTLE
FOR ASPHALT AND TAR
Fire Proof — Oil Burning
Hand and Motor Driven Spray

Other Products
CONCRETE VIBRATORS
Gasoline Engine and Electric Motor Driven Models
FRONT END SHOVELS
for Case DI Tractors
AGGREGATE DRYERS
For Stone and Sand
ASPHALT PLANTS
Portable — Stationary
Write for Circulars

White Mfg. Co
ELKHART INDIANA



STOP RUST
THE MODERN SABOTEUR

PROTECT FILTERS TANKS, CLARIFIERS and Other Metal FROM RUST With

The RUSTOP (Cathodic) System. Completely protects all types of submerged steel from corrosion.

CLEANS OLD TANKS
KEEPS NEW TANKS CLEAN

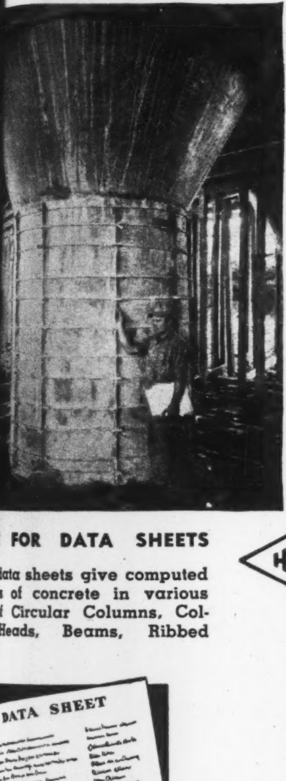
Get complete information at our booth (No. 10) at the A. W. W. A. Convention in Cleveland, Ohio—June 15-18

THE APPROVED METHOD
MATERIALS AVAILABLE

RUSTOP
THE CATHODIC SYSTEM OF CORROSION PREVENTION

ELECTRO RUST-PROOFING CO.
DAYTON • OHIO

ential Concrete Structures Given the "Green Light"



Use HAUSMAN FORMS from Stock

● Official recommendations for the maximum use of available removable metal forms for erection of essential concrete structures enables us to help you speed up durable, permanent structures of concrete.

Our stock includes adjustable shores, structural steel beams for stringers, wooden stringers, steel panels, forms for ribbed slabs, solid slabs, flat slabs, column molds. Warehouses in Toledo and Columbus, O. further facilitates our service to Engineers and Contractors.

We specialize in designing, detailing, furnishing, erecting, stripping forms for any unusual structure, as well as standard types.

Help conserve critical materials and lumber, speed up construction—maintain minimum construction costs by consulting Hausman on your form problems. Write—Wire—or Phone us for estimates and suggestions.

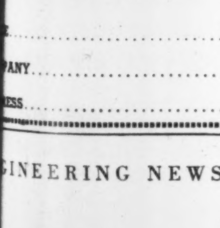
FOR DATA SHEETS

data sheets give computed s of concrete in various of Circular Columns, Col- Heads, Beams, Ribbed

HAUSMAN

The HAUSMAN STEEL Company

TOLEDO OHIO



THE HAUSMAN STEEL COMPANY, TOLEDO, OHIO

Please send me this convenient and useful tabulation of data to save time in figuring concrete volumes.

E...

PANY...

ESS...

IN SERVICE AT HOME AND ABROAD

FOR MORE THAN 30 YEARS, McCracken Concrete Pipe Machines have solved sanitation problems all over the Western Hemisphere. There are 72 McCracken plants in the United States and 27 in Latin America—each a "Defense Plant" on the home front, serving in production centers, at airports and in training and fortification areas. They're doing their bit on the foreign fronts as well, in such spots as Iceland, Alaska, and the Caribbean and — (censored).

McCRACKEN Machines Make:

Soil Pipe	Drain Tile
Culvert Pipe	Conduit

Either plain or reinforced—
4" thru 36"

*1. At the Highest Speed
*2. Of the Highest Quality
*3. At the Lowest Cost
*4. In Any Location

McCRACKEN PIPE
Corrugated

CONCRETE PIPE MACHINERY COMPANY • SIOUX CITY, IOWA, U. S. A.

POST WAR PROJECTS (Cont'd.)

Ont., Toronto—Scarboro Twp., B buck, reeve, municipal office bldg., i widening subway at Danforth Ave den Rd., sewer extens. Scarboro Bl boro Junction, Sandown Park and Park areas, watermain exten. to E. M. Baird, 1660 Kingston Rd., e

COMMERCIAL

Me., Brunswick—St. John's School, Rev. W. Dauphin, pastor, brick, steel school. $150,000.

Mo., Kansas City—St. Peter's Church, Meyer Blvd. and Holmes S ft. church. $140,000. Carroll & J. B. Shaughnessy, R. A. Long Bld City, Mo., archts.

★**Tex., Houston**—Baylor Univers Junius St., Dallas, complete d medical plant incl. bldgs., facilities, etc.

★**Tex., Houston**—Baylor University of Medicine and Dentistry, Waco, dental and medical plant. $1,000,000

Wis., Appleton—Lawrence Coll arts bldg. $200,000.

INDUSTRIAL

★**Minn., Red Wing**—POWER Northern States Power Co., 2 S St., Eau Claire, Wis., electric pow $1,500,000. CD 3/3—ENR 3/5.

★**N. Y., Bayside**—PLANT—Sylva tric Products, Inc., 500 5 Ave., N research, developmental and admi center comprising of 9 bldgs. $2,000, tin Co, 19 Rector St., New York, e

---

PROJECTS CANCELL

BY WAR PRODUCTION BO INCLUDE:

Ohio—State Highway Department, bus, grading, drainage, structures, bridge and surfacing 3,543 mi. near

Illinois—Department Public Works ings, Div. Highways, Springfield, paving 4.5 mi. and 5 bridges nea Grant.

CIVILIAN PROJECTS AUTOMAT FALL INTO POST WAR RESE

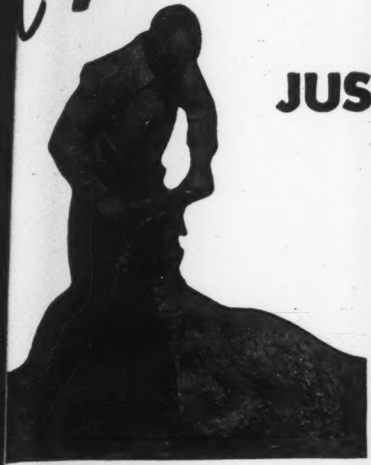
THE GORMAN-R
DISTRIBUTO
WILL restore
EQUIPME
GORMAN RUPP PUMPS

As more materials are diverte essential war uses, new equip becomes more difficult to Greater care must be given ent equipment until after Vic Let your Gorman-Rupp dist tor restore your equipment t original operating efficiency. carry parts and repairs for equipment they sell. Their cha will be reasonable.

Gorman-Rupp Self-Priming C trifugal Pumps are available immediate delivery throu Gorman-Rupp Distributors.

THE GORMAN-RUPP CO. Mansfield

CP Sinkers Can take it—



JUST GIVE THEM ORDINARY CARE

FEW hand-held drills are as well designed, as ruggedly built as CP Sinker Drills. You don't have to handle them with kid gloves or baby them on the job. But, you do have to give them reasonable care, and a few simple suggestions — like the four illustrated on this page — will help you to get maximum service from your CP-32, CP-42 and CP-10 Sinker Drills. Additional suggestions for the better maintenance of CP Sinker Drills will appear in future advertisements. Watch for them.

HOW TO GET MAXIMUM SERVICE FROM YOUR CP SINKER DRILLS

1

Remove, clean air inlet screen every two weeks —more frequently if hose is old. Drill will lose power, if the air inlet screen becomes clogged.

2

Fill reservoir with good grade of oil of proper viscosity for weather conditions. [illegible]

3

[illegible] drill in [illegible] through the machine and out of the exhaust.

4

[illegible]

★★★★★★★★★

PNEUMATIC TOOLS
ELECTRIC TOOLS
(Hicycle...Universal)
ROCK DRILLS

CHICAGO PNEUMATIC
TOOL COMPANY
General Offices: 8 East 44th Street, New York, N.Y.

★★★★★★★★★

AIR COMPRESSORS
VACUUM PUMPS
DIESEL ENGINES
AVIATION ACCESSORIES

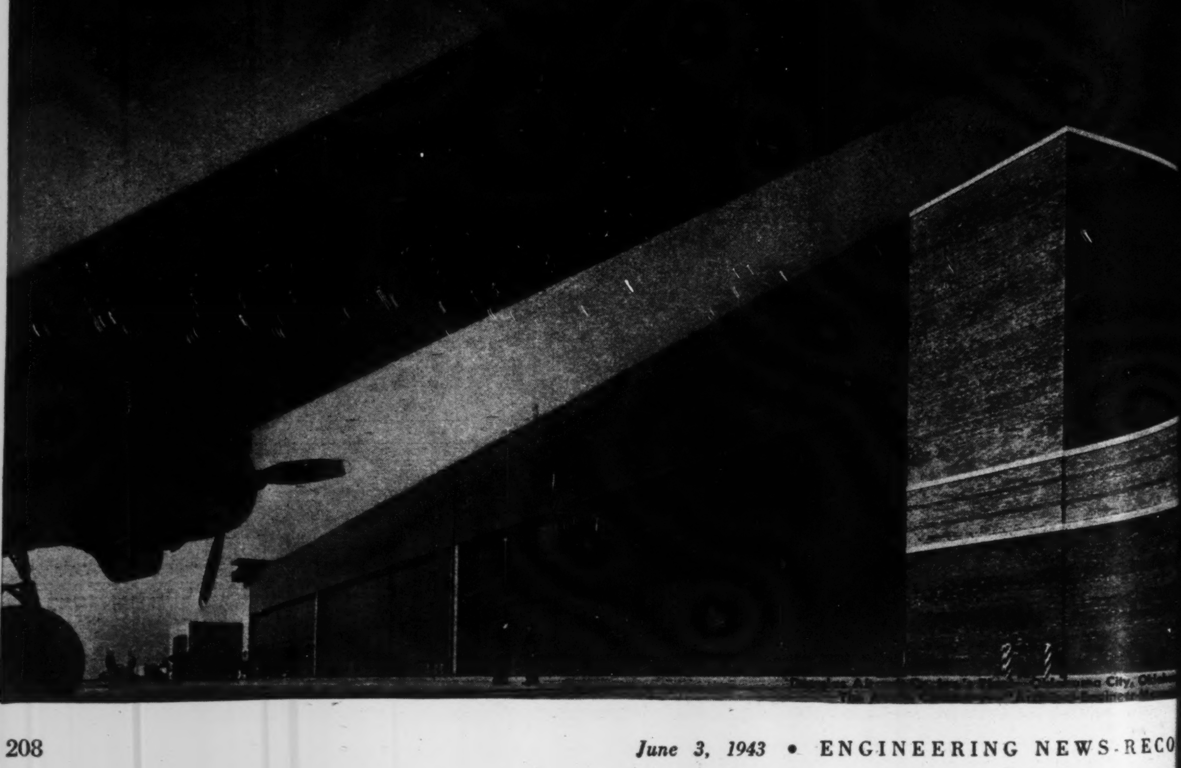
TRUSCON Steel Hangar Doors
...for every aircraft hangar need

TRUSCON hangar door designing and fabrication service . . . unsurpassed in the structural steel field . . . includes straight-slide, round-the-corner, vertical lift canopy, unbraced canopy, braced canopy, bifold canopy, and vertical lift types.

The operation of Truscon Steel Hangar Doors is simple as A-B-C. They are engineered for quick action, to meet any hangar or airplane factory need. Can be started or stopped at any point in the cycle of opening or closure . . . manually, or by completely concealed electrically-operated mechanism. Door area requirements of any width or height can be met.

Truscon's experienced engineers can help work out any hangar door problems you may have. And, they are at your service.

TRUSCON STEEL COMPANY • Youngstown, Ohio
Subsidiary of Republic Steel Corporation



[illegible] City, Okl
[illegible]

E

N

Marine

neering
brary